WOMEN WHO KNOW: THE RELATIONSHIP BETWEEN GENDER, RISK, RACE, AND HIV TESTING

A Dissertation

by

LINDSAY MICHELLE HOWDEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Sociology

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Approved by:

Chair of Committee,	Mark Fossett
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ABSTRACT

Women Who Know: The Relationship Between Gender, Risk, Race, and HIV Testing.

(May 2010)

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My main focus of interest in this dissertation is to evaluate the relationship between known risk factor for HIV and HIV testing behavior, with a particular interest in women. Utilizing data from the National Survey of Family Growth, I conduct both descriptive and logistic regression analysis to evaluate this relationship. In addition to examining this relationship for women overall, I also evaluate the differences between White and Minority women, and compare and contrast this relationship for men versus women.

In this dissertation, I did find some evidence to indicate that women with factors that put them at risk for HIV are more likely to be tested than are women without risk, however the strength of this relationship differed across types of risk factors. Drug use was consistently stronger in predicting the likelihood of testing than were sexual risk factors, indicating a "lag" in public health perception of risk due to heterosexual risk factors. I also found that African-American women had significantly higher prevalence of risk than did White women, although no difference was found in the relationship

between risk and testing. Finally, sexual risk factors were a substantially stronger predictor of testing for men than it was for women.

The findings reported in this dissertation have the potential for significant public health implications and indicate the need for further policies that target the populations identified in this research. While the evidence in this dissertation and elsewhere does suggest that these efforts have been successful for homosexual men and drug users, and marginally successful for women at risk due to heterosexual behavior, it is important that efforts that target women, especially African-American women, are increased.

DEDICATION

This dissertation is dedicated with love to my two, beautiful daughters:

Cecilia Agnes Howden

and

Viola Ruth Howden

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CHAPTER I

INTRODUCTION

In January of 2003, a major public health and media campaign, ***KNOW** HIV/AIDS*, was launched as a joint effort between the Kaiser Family Foundation and Viacom. Between 2003 and 2007, this initiative sponsored numerous television public service announcements as well as radio and print ads featuring slogans such as "Knowing is Beautiful," "Spread the Know," and "The Know is Spreading." This campaign, aimed at "normalizing [HIV] testing as a part of routine health care," represents a calculated effort to increase awareness and encourage HIV testing to a broader population than had been previously targeted. The creative director of this campaign, Alex Bogusky, notes that "These messages are designed to make the HIV test and the knowledge of one's status aspirational for anyone who is sexually active. In some ways, the test for HIV has become engulfed in the same prejudices that surround the disease. We wanted to show people that getting tested is a badge that should be worn proudly. It's smart, beautiful and sexy" (Kaiser Foundation 2004, 2005). These ad campaigns featured a young and diverse population, targeting both homosexual and heterosexual populations of both genders and a variety of ethnicities, and was broadcast on stations and during timeslots with a traditionally young demographic, such as MTV and VH1. This public health campaign is ground breaking and an important

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This dissertation follows the style of *American Sociological Review*.

development for several reasons. First, these PSAs and educational information specifically highlighted the need for HIV testing. The tone remains upbeat, portraying HIV testing in a positive light. In addition, the focus of the *KNOW HIV/AIDS* campaign mirrors several important trends that have been taking place in the incidence and prevalence of HIV/AIDS cases in the United States.

A discussion of HIV/AIDS is often centered on the problems in Africa, or as a cross for the homosexual community to bear. The reality of the current trajectory of the disease indicates that this view is decidedly narrow. Recent surveillance of the HIV/AIDS epidemic in the United States indicates that the prevalence is growing and the at-risk population is spreading. In 2007, an estimated 1.2 million individuals were infected with HIV; with women comprising approximately 230,000 of those infected (UNAIDS 2008). Although the public perception of HIV in the United States continues to focus on homosexual males, the prevalence of HIV among women is growing at a faster rate than that among males (CDC 1995). Mortality related to HIV is also important, with an estimated 22,000 deaths expected due to HIV/AIDS in the United States (UNAIDS 2005). In 2005, the Center for Disease Control reported that AIDS was the 5th leading cause of death for women aged 25-44, and the 3rd leading cause of death among Black women ages 25-44 (CDC 2008a). In addition to death related to AIDS, HIV infection is also a concern because of its high rates of co-morbidity with numerous other diseases (CDC 1992). The CDC has also reported that the proportion of all AIDS cases that are women has increased to 25.8% in 2006 (CDC 2008b). While still comprising a lower overall amount of infections in comparison to the male, homosexual community, the impact for women is not negligible. These trends indicate that the disease is becoming a concern to a wider population, expanding to women in general and African-American women in particular.

Over the past 20 years, the growing concern over the HIV/AIDS epidemic has spawned a voluminous amount of related literature. Despite the prolific nature related to this topic, there are still vast areas in need of further treatment, due to the rapidly changing nature of the disease. The increasing prevalence of HIV/AIDS among women suggests that research related to this population is also increasing in importance. In addition to the prevalence information reported above, the Center for Disease Control also reports that an estimated 25% of HIV infected individuals are unaware of their infection (CDC 2003b). Awareness of HIV status is important for two reasons. First HIV positive individuals who begin treatment of their infection early experience a more favorable prognosis and reduction in mortality compared to those whose treatment is delayed (CDC 2003b). Additionally, awareness of HIV status is important because it enables individuals to take precautions to reduce the rate of transmission to others. The importance of early detection, even prior to the onset of any symptoms, makes the promotion of HIV testing a key public health focus. Given the changing nature of the population "at risk" for the disease, the target population for HIV testing initiatives has also increased.

Another key factor in the status of HIV/AIDS in the United States is the differential distribution of HIV infection across racial groups. Research has found that minority populations, specifically African Americans, are overrepresented among those with an HIV diagnosis, and that reductions in mortality related to HIV infection have occurred more rapidly in Whites than in minority populations (CDC 2003b, 2004a; Karon et al. 2001). This indicates that African-Americans are more likely to be diagnosed with HIV, and, once they are infected, are more likely than Whites to see their disease progress to AIDS and to experience AIDS-related mortality. Prevalence of HIV by race also differs by type of transmission such that Blacks comprise 65% of diagnoses relating to IV-drug use, but 74% of diagnoses related to heterosexual contact (CDC 2003a, 2004c). All of these factors speak to the need for further research regarding the prevalence of HIV testing for women in general and minority women specifically.

In this dissertation, I present research findings related to HIV testing, with a particular focus on HIV testing in women. While universal testing is an ideal goal, it is especially important that individuals with significant risk for HIV are tested for the disease. Research in this area has the potential to influence public health initiatives, such as initiatives similar to the ***KNOW** HIV/AIDS* campaign. In addition, further research into the status of risk and testing can make these education and outreach programs more effective in reaching their target audience and encouraging HIV testing among key populations, such as women and the African-American population.

With these goals in mind, my main focus of interest in this dissertation is to evaluate the relationship between known risk factors for HIV and testing behavior. Following this introduction, I present a review of relevant previous research in Chapter II, including research regarding the changing nature of HIV/AIDS in the United States, an outline of important risk factors, the state of HIV testing, and the importance of public health initiatives in this area. Following this literature review, I detail the four parts to the substantive research conducted in this dissertation. First, in Chapter III, I evaluate the relationship between risk and HIV testing by comparing several relevant, individual risk factors to the likelihood of HIV testing for women. In Chapter IV, I seek to improve upon the findings from Chapter III by developing measurement options that increase the power of the models presented in Chapter III. Next, in Chapter V, I expand these findings to include an exploration of this relationship between risk and testing by race. Finally, in Chapter VI, I compare the findings for women with those for men, comparing the relationship between risk and testing for women with the relationship between risk and testing for men. The final chapter, Chapter VII provides a summary of the findings presented in this dissertation, along with concluding remarks.

CHAPTER II

LITERATURE REVIEW AND RESEARCH HYPOTHESES

In developing this research topic, I drew on many studies that provide vital background to guide both my topic and my hypotheses. There are several key areas of related literature that are important to detail in a discussion of HIV/AIDS in the United States in general, and related to women and HIV testing in particular. In this chapter, I first discuss the development and progression of HIV/AIDS in the United States, including a review of important trends in the disease progression. Next I discuss key factors that can increase an individual's risk for infection with HIV, and the prevalence of these factors in the United States. I then review the extent and prevalence of HIV testing as documented in previous research. Finally, I also discuss the need for HIV intervention and messages that clearly relate to their target audience. This discussion highlights the issues that motivate my research topic. I conclude the chapter by listing the research hypotheses that guide the analysis I present in the subsequent chapters.

Review of Relevant Literature

The Progression of HIV/AIDS in the United States

In 1981, physicians began to notice an unusual cluster of extremely rare forms of cancer and pneumonia infections. This cluster was unusual because the diseases were occurring in individuals who had been otherwise healthy, were severe, and progressed rapidly (Fauci 2003). With more investigation, health officials realized that those with the disease were all men who had engaged in sexual activity with other men. At first, it was hypothesized that the illness was somehow related specifically to the sexual behaviors of these men, and became portrayed in the media as the "gay disease," or the "gay cancer." Within a few years, however, cases began to be identified among other individuals, such as IV drug users, increasing concern and focus on identifying the source for this disease (Fauci 2003).

The mystery of the "gay cancer" caught the attention of a group of French virologists who had been researching the theory that certain forms of cancer could be caused by a virus. In 1983, this team of researchers identified that the "gay cancer" was in fact being caused by a virus in the "retrovirus" category, and they identified that the illness now termed acquired immunodeficiency syndrome (AIDS) was caused by a virus they named the human immunodeficiency virus (HIV) (Montagnier 2002; Fauci 2003). The next "big break" occurred in 1985, when an antibody test for HIV was developed, allowing for asymptomatic individuals to be tested for the virus. This test also allowed for the testing of the blood supply, reducing and then eliminating the spread of HIV through blood transfusions (Fauci 2003).

In the early stages of the epidemic, HIV/AIDS usually resulted in rapid disease progression and an extremely high mortality rate. In 1987, the prognosis for HIV positive patients increased dramatically with the introduction of AZT, the first antiretroviral drug (Fauci 2003). Since that time, there have been significant medical advances in treatment therapies such that, with careful monitoring and early intervention, life expectancy for individuals with HIV has been dramatically increased.

Early cases of HIV were almost entirely among men who engaged in homosexual behavior, and IV drug users. At the beginning of the HIV/AIDS epidemic, infection in women was rare and often overlooked due to the focus on homosexual men (Corea 1992). These early cases in women were almost universally attributed to the use of illegal intravenous drugs (Corea 1992). In 1996, the AIDS related mortality began to decline (Karon et al. 2001). The overall prevalence of the disease, however, continued to rise, with estimates that the prevalence of HIV worldwide rose from 100,000, in 1981, to 12.9 million by 1992 (Ehrhardt 1992). In addition, the at-risk population shifted, with cases spreading to the heterosexual population.

Between 1989 and 1991, cases among heterosexual women remained stable, and relatively low (CDC 1995). By 1993, however, cases among heterosexual women began to grow rapidly, and the percentage of women with AIDS who were infected via sexual risk surpassed the percentage for those who were infected via IV drug use (O'Leary and Jemmott 1995; CDC 1995). In 1994, the Center for Disease Control classified 66% of women with AIDS as having been infected due to heterosexual contact, compared to 27% who were infected via IV drug use (CDC 1995). From 1993 to 2000, both the proportion of all individuals with HIV that contracted the disease via IV drug use and the prevalence of HIV among drug users continued to decline. During the same period, however, heterosexual transmission of HIV increased by 9%, and between 1999 and

2002 35% of new infections were due to heterosexual contact (CDC 1995, 2003a, 2004c).

In more recent years, HIV/AIDS remains a significant concern among men who have sex with men. In 2006, 49% of HIV/AIDS cases were contracted by persons exposed through male homosexual contact. Diagnosis due to heterosexual contact, however, represented the second highest proportion of new cases, representing 33% of cases. Meanwhile, cases among women have steadily risen, such that, in 2006, 26% of all new diagnoses were in women (CDC 2008b). In addition, the mode of infection has shifted dramatically from a majority of infections in women due to IV drug use to the majority of infections in women due to heterosexual contact (CDC 1995, 2008b).

Another important trend in HIV/AIDS prevalence in the United States is the differential impact that the disease has for different racial groups. As the prevalence of HIV/AIDS in the United States has grown, African-Americans have experienced a significantly higher burden from the disease than other groups. For example, in 2006 the CDC reported that African-Americans represented nearly half of all new HIV diagnoses, and that the rate of HIV/AIDS cases in the Black population was 67.7 per 100,000, compared to 8.2 per 100,000 in the White population (CDC 2008b). In addition, disease spread in the Black community is further exacerbated in areas with high concentrations of Black population. For example, in Washington, DC it is estimated that 3% of residents are infected with HIV/AIDS, with the rate increasing to 6.5% for the Black male population (Oramasionwu et al. 2009). Because of the overall trends in health disparities, and differential access to health care, African-Americans not only experience a higher prevalence of HIV/AIDS, but higher rates of AIDS related mortality and poor disease prognosis (Oramasionwu et al. 2009).

A Review of HIV Risk Factors

These trends in HIV infection are fueled by trends in the factors that can increase an individual's risk for HIV. It has been well established that certain populations have an increased risk for contracting HIV, and that certain behaviors and characteristics can increase these risks. Most frequently, the group identified as having a high risk for HIV in the United States is males who engage in male-to-male sexual contact (CDC 2004b). This is reflected in HIV prevalence trends that continue to report the highest rates of HIV infection among this population and that homosexual men comprise the majority of persons infected with HIV (CDC 2004b). For men, the highest risk factor for HIV/AIDS has been, and continues to be, engaging in same-sex sexual behavior (Catania 2001; CDC 2004b). Another significant risk factor for men is related to incarceration in correctional facilities, with higher rates of HIV infections found among male prison populations than for the general population (Khan 2009; Hammett 2006). The majority of this risk is secondary in nature, with the primary causes related to male-to-male sexual contact or high risk drug use, however given that the characteristics of this risk population can be different from risk populations outside of prison settings it remain an important risk factor in its own right (Khan 2009; Hammett 2006).

While many patterns of risk are different for men and women, there are several key factors that represent high risk for both populations. The most important of these factors is drug use. As noted previously, one of the key early risk factors for HIV/AIDS was use of illegal, intravenous drugs. IV-drug use has remained a strong, primary risk factor for HIV for both men and women, representing a direct pathway for HIV infection due to practices such as needle-sharing among drug users. In addition to this primary method for risk, drug use also presents a secondary risk, because of individuals engaging in other, more risky behaviors while under the influences of drugs (Wilson and DeHovitz 1997). Due in part to this association, the use of cocaine in general, and crack cocaine in particular, has begun to have a strong relationship to HIV infection (de Carvalho and Seibel 2009). For female crack cocaine users, the practice of exchanging sexual favors for drugs has led to high prevalences of HIV among these women (Coates et al. 1988; Edlin et al. 1994).

Another important factor related to risk of HIV in both men and women is co-infection with other sexually transmitted infections (STIs). Co-infection between HIV and other STIs occurs due to two reasons. First, both diseases are related to sexual risk behavior, making co-infection more likely. In addition to the relationship with risk behavior, co-infection with other STIs is also related to immune response which makes the body more susceptible to infection with HIV when another infection is already present (O'Leary and Jemmott 1995). For both men and women, risk for HIV can be mitigated through an increase in the use of condoms to reduce the rate of transmission of HIV and other STIs (Slaymaker and Zaba 2003; Catania et al. 1992). Given the importance of the use of condoms to reduce the spread of HIV, this and other research suggests that the *lack* of condom use, particularly among homosexual males and individuals with multiple sexual partners, is an important risk factor for HIV infection (Slaymaker and Zaba 2003; Catania et al. 1992).

For women in particular, sexual risk factors for HIV are most often related to having a high-risk male sexual partner, such as engaging in sex with a bisexual male, a male IV drug user, or a male known to have HIV (CDC 1995; O'Leary and Jemmott 1995). One of the most important risk factors for women is sexual contact with men who have had sexual contact with other men. Research related to bisexual men has found that these men are less likely to report condom use with their female partners, and that many of these men do not disclose their bisexual behavior to their female partners (Spikes et al. 2009; Malebranche 2010). Additional research that focuses on women has also highlighted the role that male dominance in sexual relationships can have on women's risk for STIs in general and on HIV specifically. Both domestic violence directed towards women and male dominance in relationships can lead to situations where women exercise less power in their sexual relationships. These situations can lead to an increase in forced, risky sexual behaviors, and a decrease in condom use, leading to an increased risk for HIV in women (Cole et al. 2008; Rosenthal 2010).

In general, trends indicate that the prevalence of these risk factors for HIV has been increasing over time (Anderson and Stall 2002). More specifically, males have been found to have a higher prevalence of risk factors than women, for both sexual and drug use related risk. In addition, African-Americans have also been found to have a higher prevalence of risk factors than non-Hispanic Whites. Specifically, this research found that the overall prevalence of sexual risk was 9% of individuals, with significantly higher rates for males and African-Americans. Drug use was reported by 1.5% of individuals, with higher rates again reported for males and African-Americans (Anderson et al. 2006).

The Status of HIV Testing

Once at-risk populations have been identified, these populations can then be targeted for HIV prevention and reduction strategies. One key focus for public health initiatives targeting HIV/AIDS is the promotion of HIV testing (CDC 2003c). A discussion of the status of HIV testing in the United States has several important areas of focus. One common method of HIV testing is testing associated with blood donation. In 1985, when the first test for HIV was developed, the American Red Cross began routinely testing all donated blood for HIV. This means that all individuals who have donated blood since that time have been tested for HIV, regardless of their risk behavior. Numerous studies related to HIV testing have found that testing due to blood donation has led to a significant proportion of the population reporting having been tested based on this practice (Klitsch 1994; Remez 2002; Turner 1994). While the testing of donated blood represents a vital strategy in the prevention of the spread of HIV, both by informing those testing positive of their HIV status and by ensuring that recipients of donated blood are not receiving HIV positive blood, rates of this testing do not accurately reflect the prevalence of HIV testing in the United States. Research on HIV testing conducted by Anderson et al. notes:

> It is clear from the survey data that by 1995 a high proportion of adults had been tested for HIV and that testing had been done for a variety of reasons. HIV antibody testing began in 1985, and since that time, all blood donations have

> been tested. For testing to be accurately measured, it is important to distinguish between testing as a part of blood donations and testing performed for other reasons; furthermore, some respondents know that blood donation involves HIV testing, whereas others do not. For this reason, survey question sequences about HIV testing usually include direct questions about blood donation since 1985. (Anderson et al. 2000, pg. 1090)

In addition to blood donation, other "routine" testing for HIV has become prevalent, such as testing related to hospital admissions/surgery, and testing for life insurance applications, however of those who test positive for HIV, only 10% of men and 17% of women cite "routine" testing as the source of their positive test (CDC 2003c). This indicates that, while important, testing resulting from routine practices is not a major source for informing HIV positive individuals of their status.

Another HIV testing strategy is to encourage women to be tested for HIV during pregnancy. Significant reductions in transmission of HIV infection from mother to newborn has been linked to prenatal testing and treatment of HIV infection (CDC 2002). While women are able to refuse HIV testing during prenatal care, testing of pregnant women has become widespread. In 2002, it was estimated that 69% of pregnant women received an HIV test at some point during their pregnancy (Anderson et al. 2005). In addition to research on pregnancy-related testing in general, the CDC studied the way programs for pregnancy –related testing are implemented (CDC 2002). Specifically, programs can either take an "opt-out" or "opt-in" approach. For the "opt-out" approach, women are told that the standard battery of prenatal testing includes HIV testing, but that they have the option to decline it. For the "opt-in" approach, women are told during prenatal testing that they can also be tested for HIV, but they must specifically request this test. This approach varies in the United States on a state-by-state basis. In general, research has shown that the "opt-out" approach resulted in a higher percentage of testing than the "opt-in" approach, however overall rates of pregnancy-related testing have remained high (CDC 2002; Young et al. 2009). While testing related to blood donation and pregnancy continues to be of vital importance in the detection of HIV/AIDS, both types of testing are mainly passive in nature and do not represent the relationship between significant risk behavior and receiving an HIV test.

Overall, research indicates that the percentage of Americans reporting that they had been tested for HIV, outside of blood donation, has been steadily increasing over time (Anderson et al. 2000). For example, early research using the 1988 wave of the National Survey of Family Growth (NSFG), the same survey I utilize in this dissertation, found that only 16% of women reported having been specifically tested for HIV, outside of blood donation (Turner 1994). In contrast, results from the 2002 NSFG data indicates that 54.9% of women reported having been tested for HIV outside of blood donation (Anderson et al. 2006). In general, research detailing the proportion of Americans who have been tested report a rate of testing that is directly related to the year of the study, with higher rates of testing reported for more recent studies (Klitsch 1994; Turner 1994; Remez 2002; Ebrahim et al. 2004; Kaiser Foundation 2006, 2008). In addition, all of these sources also report higher rates of testing among African-Americans than among Whites, corresponding with their higher disease prevalence. Despite their overall higher testing rates, research has also shown that knowledge about treatment and prevention was higher for Whites than for African-Americans (Ebrahim et al. 2004). In addition to

HIV testing rates in general, research has also focused on testing rates among those with significant risk factors for the disease.

While general testing for HIV is important, it is even more important that individuals with significant risk factors are being tested for the disease. There have been several studies that have evaluated the likelihood of testing in relationship to risk status. For example, early research using the 1988 NSFG found that women with previous STI infection were more likely to report having been tested for HIV, and that the likelihood of testing increased as the number of sexual partners increased (Turner 1994). In addition, research using the National Health Interview Survey found that 73% of individuals with high risk had been tested, although this study uses a fairly narrow definition of risk (Remez 2002). This and other studies also note that the *perception* of risk status is just as important to the likelihood of being tested as is *actual* risk status. For example, a 2006 Kaiser Foundation study found that 61% of those who had never been tested for HIV said that the reason they had not been tested was because they did not feel they were at risk for HIV (Kaiser Foundation 2006). Research using the most recent wave of the NSFG found that, while 25% of respondents with a high risk for HIV reported having been tested in the previous 12 months, testing was more prevalent among those at risk due to drug use than due to sexual risk (Anderson et al. 2005).

Another important factor in HIV testing is, for those who test positive for HIV, at what stage in their disease progression they learned of their status. In most cases, the onset of symptoms does not occur until the disease has already progressed significantly. The earlier a diagnosis is received, then the earlier treatment can begin, significantly increasing the time between the diagnosis of HIV and the progression to AIDS, as well as reducing HIV/AIDS related mortality. Recent research has also found that individuals who begin treatment early in their disease progress also are less likely to transmit the disease to others, since their viral load is able to be kept lower than those who do not begin treatment until later in the disease process (Granich et al. 2009; Grigoryan et al. 2009). Research related to "late" versus "early" testing found that "late" testers were more likely to be young, Black or Hispanic, and to have been infected via heterosexual contact (CDC 2003b). In addition, this same study found that the majority of "late" testers noted the reason for their test was because of illness, while the majority of "early" testers noted the reason for their test was because of perceived risk status (CDC 2003b).

The Importance of Targeted Public Health Initiatives

The research reviewed in the previous sections clearly emphasizes the importance of promoting HIV testing in general, and increasing the prevalence of testing among specific, high risk populations. The key, then, is to effectively disseminate this information to the target audience. In developing public health initiatives, the overwhelming finding has been that there is no "one size fits all" message. The most effective messages are the ones that find a way to specifically address their target audience. For earlier, more established risk populations, public health strategies have focused on IV drug users and the homosexual male populations. For example, programs such as controversial needle exchange and clean needle programs have targeted IV drug users and gay bars have hosted HIV testing drives to target the homosexual male population. As the risk population has expanded, so has the need for these targeted initiatives.

As mentioned earlier, a key inspiration for this research has been the ***KNOW** AIDS* campaign that was a joint venture between the Kaiser Foundation and Viacom. In addition to the broad campaign mentioned in the introduction to this dissertation, this program also included a groundbreaking, multifaceted campaign that specifically targeted a young, African-American audience with a message that emphasized the importance of HIV testing, as well as safer sex practices and better communication with sexual partners. This campaign included several avenues for spreading these messages. For example, storylines on television shows that are highly rated in the target demographic incorporated these public health messages, and were interspersed with PSAs that featured celebrities that are influential in the African-American community. Additionally, these efforts were followed up with a special hotline for testing referral and mobile testing events. The Kaiser Foundation followed up these efforts with a telephone survey to determine how effective they were in reaching their target audience and in retention of their message. The results of this survey were published by the Kaiser Foundation (Kaiser Foundation 2004). Their survey found that 80% of their African-American respondents overall, and 90% of African-American respondents in their target age range reported having viewed at least some of this content. Additionally, the survey found high rates of retention of the content of the message, with 28% of respondents reporting that they had sought to be tested for HIV following exposure to these messages. Finally, this survey found that viewership and message retention was higher in their target audience for this “culturally focused” campaign than for PSA campaigns that were more broad in focus (such as NBC’s “The More you Know” campaign). These findings provide support for the need for the development of Public Health initiatives and messages that directly speak to their target audience.

In addition to this work by the Kaiser Foundation, there have been several other, more formal, research studies that have also emphasized the need for targeted and culturally sensitive intervention strategies. While there has been extensive research on this topic in general, given the focus of my dissertation research, I have chosen to focus specifically on research related to HIV prevention strategies. More specifically, previous research has established that for women in general, and African-American women specifically, the most effective strategies are ones that specifically target women, or African-American women. For example, in a study by Kalichman et.al., researchers assigned African American female participants to watch one of three videos: 1. A professionally made video featuring White professionals discussing facts related to HIV, 2. A video featuring African-American women providing the same information as the first video, or 3. A video featuring African-American women providing a similar message, however this time the message was framed in the context of the attitudes and values that are relevant to the African-American community (Kalichman et al. 1993). The study participants were evaluated before, just after watching the videos, and two weeks following to determine their knowledge of HIV/AIDS, reactions and opinions towards the videos, and any risk-reducing behavior. The researchers found that, while all three videos produced changes in knowledge and behavior, the video that was most effective was the one featuring a culturally relevant message provided by an African-American presenter.

In a study similar to the previous research, Kalichman and Coley further explored the effectiveness of context-framing in reaching African-American women (Kalichman and Coley 1995). In this study, the researchers again utilized a sample of African-American women and assigned them to watch one of three HIV-intervention videos. In the first of these videos, the presenter was an African-American male who discussed the general facts related to HIV testing and risk. In the second video, the presenter followed an identical script as the first video, but was an African-American woman. Finally, the third group viewed a video where an African-American woman presented the content, but the message focused specifically on the impact on the African-American community. In addition, the message was framed using a "loss frame" that emphasized what the individual and the community stood to lose if they were not tested. As in the previous study, the participants were evaluated immediately following the video as well as two weeks later. The researchers found that matching the gender of the presenter to the participants significantly improved the effectiveness of the message. They also found that context-framing significantly motivated the participants to engage in risk reducing behaviors during the 2 week follow-up period.

A final study evaluated for this portion of the literature review, conducted by Apanovich et al. sought to improve upon the effectiveness of the previous two studies by developing videos that will be most effective depending on their participant's perceived risk. The research in this study hypothesized that "loss frame" context-framing will only be effective for participants who are uncertain of the results of a potential HIV test due to a perception of HIV risk, while participants who are certain of the results of a potential test are more likely to be motivated by a “gain-framed” message (Apanovich et al. 2003). For this research, the authors developed videos that featured a message that detailed what the participant could gain from receiving an HIV test (“gain-framed”) or what the participant could stand to lose from not being tested (“loss-framed”). The researchers were particularly interested in the impact of these messages on ethnic minority women, and the majority of their sample of 480 women consisted of African-American women. The presenters featured in their videos consisted of ethnically diverse individuals. Following the viewing of the video, the researchers conducted follow up interviews by phone 6 months after the initial contact. The researchers in the case found strong support for the effectiveness of “gain-framed” messages for individuals with a low perception of risk and marginal support for the effectiveness of “loss-framed” messages for individuals with a high perception of risk.

These studies have clearly established that, when developing Public Health messages, it is not only important what you say, but also who says it and how it is said. Intervention strategies that are the most successful are the ones that most specifically match their message to their target audience. While this dissertation does not address specific public health strategies per se, research related to the development of culturally specific initiatives is an important influencing factor in the development of my dissertation topic. An in-depth evaluation of risk, HIV testing, and the relationship between the two is important in determining which populations are most in need of these targeted health strategies. When operating in an environment with limited resources, it is vital that strategies are developed that can maximize effectiveness. Given that this previous research has found that strategies are most effective when they are tailored to their target audience, this dissertation is aimed at helping to shed light on the populations that are most in need of receiving these messages.

In light of all of the research discussed above, there are many that now advocate for universal testing for HIV/AIDS. For example, a recent article in the medical journal *The Lancet*, recommends that *all* individuals be tested for HIV yearly, beginning at the age of 15 (Granich, et.al, 2009). Although this recommendation is somewhat controversial, in particular due to the cost involved with putting this into practice, the authors argue that universal testing will quickly become a less costly option when compared to the amount of money spent on illness from late-stage HIV/AIDS. Although Granich et al.'s recommendations represent a somewhat radical undertaking, it is in a similar vein to the CDC's own initiative, "Advancing HIV Prevention: New Strategies for a Changing Epidemic" (CDC 2003c). This initiative consisted of a four part strategy, including:

- Make HIV testing a routine part of medical care.
- Implement new models for diagnosing HIV infections outside of medical settings
- Prevent new infections by working with persons diagnosed with HIV and their partners.
- Further decrease perinatal HIV transmission.

(CDC 2003c, pg. 331)

Research Hypotheses

Given this previous research and data related to trends in HIV/AIDS in the United States, I have developed several research hypotheses to guide the research presented in this dissertation. For this research, I have used the National Survey of Family Growth, 2002 data (NCHS 2002). I have also taken into account the constraints of this data source when planning the following research hypotheses. These constraints will be discussed in further detail in the methodology sections of the following chapters.

Previous research conducted using NSFG data has examined testing behavior using descriptive methods, however there remains a need to evaluate this topic more extensively. In addition, trends in HIV/AIDS in the United States have also indicated the importance of women as a study population, due to recent increases in the prevalence of HIV/AIDS among women. The main focus of the research I conduct in this dissertation, therefore, is to extensively evaluate the state of HIV testing among women. HIV testing is especially important for women who have a known risk factor for acquiring the disease. The knowledge of whether or not women who are at a high risk for contracting HIV are being tested has the potential for significant public health implications.

In this dissertation, I address four separate empirical questions. Each of these sections is unified in focusing on untangling the relationship between having a known HIV risk factor and seeking to be tested for the disease in women. In addition to evaluating this relationship overall, I also seek to determine if women are significantly different in their testing behavior than men as well as to determine differences between women by race or ethnic group. In the first empirical section of the dissertation, I determine the relationship between specific, individual and known risk factors for HIV and women's testing behavior. In this section, each individual risk factor is evaluated separately to determine their ability to predict HIV testing behavior in women. This first section is guided by two main research hypotheses:

H.1: Women who are at an increased risk of becoming infected with HIV due to having a known risk factor for the disease are hypothesized to also be more likely to actively seek to be tested for HIV.

H.2: Women who are at risk of developing HIV due to drug use are hypothesized to have a higher odds of receiving an HIV test than are women who are at risk due to sexual behavior.

This second hypothesis is motivated by the previous research that found that the HIV epidemic in women began in relation to IV drug use on the part of women themselves. Because of this relationship between drug use and risk in women, early education and prevention efforts for women have specifically targeted this population. In the past decade, however, there has been a significant increase in women who have become infected with HIV due to sexual risk behaviors. Because of this more recent shift in HIV risk in women, it is expected that public perception of the need for women to be tested due to sexual behavior has experienced a "lag" behind perception of the risk due to IV drug use. These first two hypotheses are addressed in Chapter III.

In the second section of my dissertation, I address the methodological question of how to best measure HIV risk, given the available data. The NSFG data, which I utilize in this dissertation, asks respondents about numerous behaviors that have been clearly shown by previous research to increase risk for HIV. Although this data includes a large and robust sample, the low overall prevalence of each individual risk factor (both in the sample and in the population overall), can lead to low statistical power in determining the relationship between each individual factor and HIV testing behavior. The measurement of these risk factors can also be further complicated by issues such as measurement error, due to misunderstanding or dishonesty on the part of the respondent, or multicolinearity, since many of these risk factors (such as the questions measuring sexual behaviors) can occur simultaneously. To address these issues, the second section of my dissertation uses a variety of methods to measure risk status in relation to testing behavior, in order to determine what method can increase statistical power while maintaining substantive integrity. This section is motivated by the following hypothesis that:

> **H.3:** Due to the multi-faceted nature of HIV risk, the relationship between having known risk and testing behavior will be different depending on the method used for measuring HIV risk.

This third hypothesis is addressed in Chapter IV.

The third section of my dissertation will evaluate the relationship between race/ethnicity, risk, and HIV testing behavior in women. Previous research has found that the prevalence of HIV is significantly different for different racial groups.

Specifically, the population of African-American women with HIV has dramatically increased in recent years. This evidence indicates the importance of including a close evaluation of race in general, and African-American race specifically, when studying HIV testing behavior. Given this evidence, I also estimate separate models by Race/Ethnicity to further evaluate the relationship between risk and HIV testing behavior, using the following hypotheses:

H.4: Women of different race/ethnic groups are hypothesized to differ in their prevalence of known risk factors. Following previous research, I hypothesize that African American women will have the highest prevalence of risk.

H.5: In addition to risk factors, women are also hypothesized to differ in their HIV testing behavior in accordance with their difference in risk.

The 4^{th} and 5^{th} hypotheses are addressed in Chapter V.

While the primary focus of this dissertation is on the HIV testing behavior of women, it is also necessary to include a discussion of the testing behavior of men in order to provide an adequate comparison between the two groups. As previous research has suggested, different population groups often necessitate different prevention and intervention strategies targeting these groups. In this dissertation, I am interested in providing information about the specific needs of women and the relationship between their risk and HIV testing behavior. In this final section, I aim to determine the specific ways that women differ from men in their HIV risk, testing behavior and the relationship between the two, so that more effective prevention and intervention strategies can be developed to target this population. Specifically, I have 2 separate hypotheses regarding the differences between men and women. These hypotheses are:

H.6: Women and men will differ in their HIV testing behavior. While there is a high overall prevalence of HIV testing in women due to pregnancy related testing, when HIV tests are sorted by type of test, Men will be more likely to report having actively sought to be tested due to perceived risk. In other words, there will be significant differences between men and women in the reason why they were tested for HIV.

H.7: The relationship between having a known risk factor and being tested for HIV will be different for men and women. Specifically, I hypothesize that having a sexual risk factor for HIV will more strongly predict testing behavior for men than for women.

Given the strong public health emphasis on targeting homosexual males, as well as the intense public perception of the risk associated with this population, I expect to find a stronger relationship between risk and testing for HIV in men that I do for women. These two final hypotheses are addressed in Chapter VI.

CHAPTER III

THE CONNECTION BETWEEN RISK FACTORS AND HIV TESTING

In this chapter, I examine the relationship between known risk factors for HIV and HIV testing in women by evaluating each risk factor's effect on a woman's likelihood of having been tested in her lifetime. Additionally, I categorize HIV testing based on the reason for the testing, so that the relationship between risk and testing can be evaluated in terms of routine testing associated with: (a) blood donation, (b) pregnancy and other routine procedures, or (c) other reasons for testing. While all of these reasons for receiving an HIV test are important, it is this "other" category that I am most interested in. As I mentioned in the previous chapter, testing related to blood donation or pregnancy is generally passive in nature, while testing for respondents who report "other" reasons for receiving an HIV test is more active in nature. The analyses I performed for this chapter evaluate the relationship between several key risk factors and HIV testing, with separate analyses conducted for all HIV tests, tests excluding blood donation, and test excluding blood donation or pregnancy/routine related testing.

Data and Methods

In this and subsequent sections of this dissertation, I draw on data from the 2002 wave of the National Survey of Family Growth. This is an important, large scale, nationally representative survey that is conducted periodically by the National Center for Health Statistics, and it is a crucial resource for research in this area. Topics included in this survey include a wide range of questions concerning sexual and reproductive behavior and health. In 2002, this survey included both male and female respondents between the ages of 15 and 44, with an over-sample of teenagers, Blacks and Hispanics. The 2002 version of this survey is notable for being the first to include males; however a different version of the survey was used for male respondents, resulting in two separate datasets: one for male respondents and one for female respondents. In this chapter I examine only the data for female respondents, and defer analysis for male respondents to Chapter VI. The female sample of respondents included 7,643 women.

The National Survey of Family Growth utilized female face-to-face interviewers to administer in-depth questionnaires. Sensitive questions, including questions related to most HIV risk factors, were entered directly into the computer by the respondent to enhance the reliability and confidentiality of answers. While respondents are asked about a variety of sexual behaviors and sexually transmitted diseases, they are not asked whether or not they are presently HIV positive. Respondents also are not asked about the results of any tests that they have received, however, questions related to HIV testing are asked. From these questions I have the opportunity to perform analyses of HIV risk factors and their relationship to HIV testing.

In this chapter, I use logistic regression to assess the relationship between various risk factors and HIV testing. I estimated two separate models for each of three dependent variables for a total of 6 separate logistic regression analyses. These three dependent variables represent three HIV testing outcomes:

1. Whether the respondent has had ANY HIV test
2. Whether the respondent has had an HIV test unrelated to blood donation
3. Whether the respondent has had an HIV test that is unrelated to blood donation, pregnancy, or other routine testing.

The first model for each dependent variable will estimate the effect of relevant risk factors on HIV testing without "competing" control variables, while the second model will include several control variables.

Prior to estimating the logistic regression models, I evaluated the possibility of multicolinearity between my independent variables by examining the tolerances for each variable. The tolerance for each independent variable did not indicate the presence of multicolinearity.[1] The NSFG dataset also includes sample weights to take into account over-samples in the data. I use these sample weights as appropriate, based on instructions included in the NSFG technical documentation, for both descriptive and logistic regression results (NCHS 2006). To aid in interpretation, I report the antilog of the logit coefficients, or odds ratios, for each of my independent variables. For each dependent variable, I compare across models to determine if risk factors that significantly predict HIV testing behavior in the absence of controls remain significant in the full model. I review across dependent variables, to determine if significant risk factors vary when the outcome includes or excludes testing that is passive in nature.

[1] Tolerances were all 0.45 or higher.

Relevant Variables

The NSFG includes many variables that are relevant for the analyses I report in this chapter. The two primary categories of variables relate to HIV testing behavior and known risk factors. These variables were derived from a series of questions respondents were asked related to their sexual and drug use behaviors, questions related to their HIV testing behavior, and follow up questions regarding any HIV test they might have received.

Dependent Variables

The main dependent variable of interest in the analysis presented in this dissertation is whether or not a respondent has received an HIV test. Questions included in the 2002 NSFG related to testing behavior include: whether or not the respondent has received an HIV test, whether the respondent has given a blood donation, reasons why the respondent was tested for HIV, and where the HIV test was obtained. In 1985, the American Red Cross began routinely testing all donated blood for HIV antibodies. This means that all individuals who have donated blood in the United States since 1985 have received an HIV blood test. While this testing plays a vital role in the prevention of the spread of HIV, it is "passive," compared to testing by individuals who are actively seeking testing. Additionally, respondents are asked if they have ever received an HIV test apart from one they received while donating blood.

For women, the presence of routine HIV testing during prenatal care has also led to "passive" testing for many women. While prenatal testing is not universal, due to lack of prenatal care or individual refusal, it has become highly prevalent. As a follow up question to asking whether or not the survey participant has received an HIV test, the NSFG data asks the respondent for the reason why an HIV test was obtained. These possible reasons for testing include:

- Hospitalization or surgical procedure
- To apply for health or life insurance
- "Just to find out" if infected
- Because of referral by a doctor
- To apply for a marriage license
- Because of pregnancy or as a part of prenatal care
- Some other reason

I use this question to differentiate between those who have "actively" sought to be tested for HIV from those who were tested for other reasons. Using these multiple sources for HIV testing information, I classify all respondents into 4 testing categories:

- No HIV test
- HIV test related to blood donation only
- HIV test related to pregnancy or other routine practice
- HIV test unrelated to blood donation, pregnancy, or routine practice

In this section of my dissertation, I will estimate separate models using different dependent variables created from these classifications, as follows:

Any HIV Test – This dependent variable is a dummy variable coded "0" if the respondent does not report any HIV test and is coded "1" if the respondent has had any

HIV test, regardless of the reason given. Additionally, this variable is coded "1" if they have donated blood since 1985.

HIV Test, excluding blood donation – This dependent variable is a dummy variable coded "0" if the respondent does not report any HIV test or if the respondent's *only* HIV test was due to blood donation. This variable is coded "1" if the respondent reports an HIV test unrelated to blood donation, regardless of the reason given for the test.

HIV Test, excluding blood donation, pregnancy, or routine practice –This variable is a dummy variable coded "0" if the respondent does not report any HIV test or if the respondent's only reported HIV test was due to blood donation. The variable is also coded "0" if the respondent reports that the reason for their HIV test was because they were pregnant, because of hospitalization or other surgical procedure, to apply for health or life insurance, or to apply for a marriage license. This variable is coded "1" if the respondent lists the reason for their HIV test was given as just to find out if infected, referral by a doctor, or "some other reason."

Independent Variables – HIV Risk Factors

The main independent variables in my analyses are related to behaviors that increase an individual's risk of contracting HIV. Several of these risk factors were discussed previously in the literature review, and all have been established in previous research to be relevant. The NSFG data allow for the measurement of numerous individual risk factors for HIV. In this chapter, I include each factor in the analysis individually. For sexual risk factors, questions were asked only of individuals who reported ever having had a sexual partner. I code other individuals to indicate that they do not have any of the sexual risk factors. In addition, several sexual risk variables for women are related to sexual activity with male sexual partners. Previous research has established that risk of HIV transmission is extremely low through same sex behaviors among females. Accordingly, I only consider the heterosexual behavior of women in the present analysis. The majority of these risk factor variables are dummy variables that are coded "1" if the respondent reports the presence of the risk factor and "0" if they do not. The relevant categories of risk included in the dataset include:

Involuntary Intercourse – The dataset includes several questions on involuntary intercourse including whether or not the respondent's first sexual experience was voluntary as well as whether or not they had ever been raped. Respondents are considered to have this risk factor if they indicate that they have been subjected to involuntary intercourse at any time during their lifetime. The questionnaire asks about the "wantedness" of sexual intercourse, and as such can encompass both violent rape by a stranger, as well as intercourse that the respondent didn't actually *want* to engage in but ultimately agreed to.

Drug Use – Several relevant questions related to drug use are included in the NSFG dataset. These questions include whether or not the respondent has used IV drugs, crack, or cocaine in the previous 12 months. IV drug use is a significant factor for HIV, however the extremely low overall prevalence of reports of IV drug use in the sample made this factor difficult to measure alone. Instead, I created a "drug use" variable using data compiled from the drug use questions. Respondents are coded as "1" if they report any of these drug use behaviors.

Bisexual Partner – For women, one important risk factor is whether or not she is engaging in sexual activity with a male who has also engaged in sexual activity with another male. This question only partially assesses risk since it is limited to sexual activity of a partner that the woman is aware of. Additionally, this risk factor is included only for women and limits responses to sexual partners in the previous 12 months.

IV Drug Using Partner – This question asks respondents if any of their sexual partners in the previous 12 months have used IV drugs. Again, responses are limited to the behavior of a partner that is known to the respondent.

Prostitution – Women are asked several questions related to prostitution. Respondents are asked whether or not they have ever received money or drugs in exchange for sexual activity and whether or not they have ever paid money or drugs in exchange for sexual activity. I use these answers to create two dummy variables. The first is coded as "1" if the respondent reported having *received* money or drugs from a male in exchange for sexual activity, while the second variable is coded "1" if the respondent reported having *paid* money or drugs to a male in exchanged for sexual activity.

Sex with an HIV+ Partner – Respondents are asked whether they have knowingly engaged in sexual activity with a partner that they knew to be HIV positive in the previous 12 months. As in previous risk factors, this is limited to instances where a partner's HIV status is known to the respondent.

Has other STI – I created this dummy variable from a series of questions that ask if the respondent has been treated for one of a series of sexually transmitted infections (STIs) in the previous 12 months. STIs included in the questionnaire are gonorrhea, Chlamydia, herpes, syphilis, or genital warts. Treatment received for HIV infection is not included. Respondents are coded as "1" on this variable if they report receiving treatment for any one or more of these STIs.

Unprotected Sex – This variable measures a respondent's risk due engaging in unprotected sex. I create it based on the responses from two questions. The first concerns frequency of condom use in the previous 12 months, while the second concerns the number of sexual partners in the same period. I categorized respondents as "0," for low risk, if they reported zero or one sexual partner in the previous 12 months, or if they reported that they used a condom "every time" or "most of the time" they engaged in sexual intercourse in the previous 12 months. I coded respondents as "1," representing risk, if they reported 2 or more sexual partners in the previous 12 months along with moderate or infrequent condom use.

Non-Monogamous Partner - This question asks the respondent if in the previous 12 months they have engaged in sexual activity with a partner that they knew to also be engaging in sexual activity with another, female partner.

Number of Sexual Partners – Risk for HIV increases as the total number of a person's sexual partners increases. Accordingly, I measure this risk by including a variable that indicates the total number of sexual partners a woman reports.

Control Variables

In addition to factors known to be associated with HIV infection, there are other variables that should be included in the analysis. These variables have also been established to be related to prevalence of HIV infection, and several are related to HIV risk behavior as well. These additional variables are:

<u>Race/ethnicity</u> – The NSFG allows for the measurement of three racial categories (White, Black, and other), with one category for ethnicity, Hispanic. I used these to identify the following groups: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic other. For the remainder of this dissertation, I refer to these groups as White, Black, Hispanic, and Other. I use dummy variables coded "1" if the respondent is of the specified group and "0" for all other respondents.

<u>Marital Status</u> – The NSFG data allows for six marital status categories including married, unmarried-cohabiting, divorced, married-separated, widowed and single. I group respondents in the divorced, separated, and widowed categories into one "previously married" category, and code the resulting four categories as a series of dummy variables coded "1" if the respondent is of the specified marital status and "0" for all other respondents.

<u>Education</u> - I measure educational attainment based on 3 major categories of attainment: less than a high school degree or equivalent, high school graduate or equivalent without any college, and high school graduate with at least some college or higher. These are measured as 3 dummy variables coded "1" if the respondent has the specified level of educational attainment and "0" for all other respondents.

Income – I measure income based on the respondent's pre-tax family income for the previous year. Respondents were given 14 categories of income, and could give their responses in weekly, monthly or yearly amounts. These categories ranged from a low of $5,000 or less per year to a high of $75,000 or more. I leave the original coding of the income categories intact and thus include income as a continuous variable, ranging from 1-14 depending on reported category.

Health Insurance – This variable measures whether the respondent had been covered by any health insurance program for all of the previous 12 months. This includes any type of coverage such as private insurance, employer-sponsored health insurance, and government-sponsored programs (Medicaid, Medicare, etc). I coded respondents "1" if they reported being covered for all of the previous 12 months and "0" if they had no health insurance or experienced a lapse or loss of coverage.

Place of Residence – This variable categorizes respondent's place of residence as urban, suburban, or rural. I classified respondents as urban if they live in a census designated metropolitan statistical area, in a central city. I classified respondents as if they live in a census designated metropolitan statistical area that is not the central city, and rural if they do not live in a census designated metropolitan statistical area. As before, this is measured using a series of dummy variables.

Age – I measure respondent's age at the time of the survey based on reported years of age.

Ever been pregnant – For female respondents, I created a dummy variable that is coded "1" if the respondent reports having ever been pregnant, regardless of the outcome of the pregnancy. It is coded "0" if the respondent has never been pregnant.

Descriptive Results

Before reporting results from the logistic regression analyses, I first report descriptive statistics for the variables in my analyses. The initial, univariate descriptive results are presented in Tables 3.1 and 3.2. All results reported are weighted to take the NSFG sample design into account. For the dependent variable, HIV testing, 68.33% of the sample reported having had an HIV test, with 28.28% reporting tests unrelated to blood donation, pregnancy or other routine testing. Women who had only had an HIV test due to blood donation comprised 13.37% of the sample, while the remaining 26.68% consisted of women whose sole HIV test was due to pregnancy or other routine testing.

Also reported in Table 3.1 are the distributions of the risk factors associated with HIV infection. Percentages reported in this table refer to percent of the total sample reporting the risk behavior. The most prevalent of all risk factors is sex with a non-monogamous partner (9.37%) closely followed by unprotected sex (9.14%). The third most prevalent risk factor was involuntary intercourse, although this was almost half of the prevalence of the first two at 4.68%. The least prevalent factors were sex with a male known to be infected with HIV (0.58%) and women who have paid money or drugs to a male in exchange for sex (0.95%).

Table 3.1. Descriptive Results, HIV Testing Categories and Risk Factors

	Percent	Mean	Standard Deviation
HIV Testing:			
No HIV Test	31.68	---------	---------
Blood Donation	13.37	---------	---------
Pregnancy Related or Routine Test	26.68	---------	---------
Other HIV Test	28.28	---------	---------
Risk Factors:			
Involuntary Intercourse	4.68	---------	---------
Drug User	3.20	---------	---------
Bisexual Part.	2.51	---------	---------
IV Drug-Using Part.	3.19	---------	---------
Prostitute	2.06	---------	---------
Sex with Prostitute	0.95	---------	---------
Sex with HIV+ Male	0.58	---------	---------
Has Other STI	3.40	---------	---------
Non-Monogamous Part.	9.37	---------	---------
Unprotected Sex	9.14	---------	---------
Age	---------	29.97	0.17
Number of Sex Part.	---------	5.63	0.13
Income	---------	9.34	0.08

Note: Since these results are weighted to take into account the NSFG sample design, these are linearized standard errors, rather than standard deviations. The actual standard deviations for unweighted versions of these variables are substantially higher.

Table 3.2. Descriptive Results, Additional Independent Variables

	Percent
Marital Status:	
Married	45.97
Cohabiting	9.08
Previously Married	9.89
Single	35.06
Education:	
< High School	21.24
High School Grad.	27.97
> High School Grad.	50.79
Place of Residence:	
Urban	49.00
Suburban	33.31
Rural	17.68
Race:	
White	65.76
Black	13.89
Hispanic	14.82
Other	5.53
Health Insurance	77.04
Ever Been Pregnant	65.69

Table 3.1 also reports the mean values for the 4 continuous variables used in the present chapter. The mean age of respondents was 29.97 years of age. The mean income reported was 9.34, which corresponds to the $30,000 - $34,999 per year range. The mean number of sexual partners reported for the respondent's lifetime prior to the survey was 5.6. Included in this mean are women who reported no or one male sexual partner in their lifetime, which comprise 10% and 21% of the sample, respectively (not shown).

In Table 3.2, I present the univariate descriptive results for the additional independent variables included in the full models. This includes marital status, race, education, place of residence, health insurance status, and whether or not the respondent has ever been pregnant. The majority of the sample reports being either married (45.97%) or single (35.06%). White respondents comprise 65.76% of the sample, followed by Hispanic respondents (14.82%), and Black respondents (13.89%). For education, most respondents had some college (50.80%), high school graduates was the next most common (27.97%), followed by no high school diploma (20.92%). The majority of respondents were urban residents (49.00%), followed by suburban residents (33.31%) and rural residents (17.68%). A total of 77.04% had health insurance and 65.69% has ever been pregnant.

In Table 3.3 I report the distribution across categories of HIV testing for subgroups of respondents. In this table, percentages total across the rows. For example, of those women who reported involuntary intercourse, 23.23% reported that they had never had an HIV test, 10.59% report having only had an HIV test due to blood donation, 34.59% report a pregnancy related or other routine test, and the final 31.59% report having had a test unrelated to blood donation or routine testing. For all risk factors, the majority of respondents reported having had an HIV test of some type. The highest percentages of "other" HIV tests were for respondents who reported drug use (50.1%) or having another STI (49.2%). Even in these categories, however, 21.9% and 19.3% respectively reported never having been tested for HIV. With the exception of the distribution for the variable "sex with HIV+ male," all other bivariate distributions had a χ^2 statistic that was significant at the $p < 0.10$ level (involuntary intercourse), or the $p < 0.05$ level (all other risk factors).

The second half of Table 3.3 reports results of a cross tabulation of the other categorical independent variables with the three HIV testing categories. For race, I found that a higher percentage of Black respondents are found to have been tested apart from blood donation or pregnancy/routine testing (41.04%) than were other races. Hispanic respondents were more likely than other groups to have received only a pregnancy related or routine test (27.95%), and White respondents were more likely than other groups to have only had a test due to blood donation (16.95%). Those in the "other" race category had the highest percentage of never having been tested (42.47%).

Table 3.3. Descriptive Results, Percent Distribution of Each Testing Category for Categorical Independent Variables

	No HIV Test	Blood Donation	Pregnancy Related or Routine Test	Other HIV Test	Total
Risk Factors:					
Involuntary Intercourse*	23.23	10.59	34.59	31.59	100
Drug User**	21.93	10.28	17.68	50.11	100
Bisexual Part.**	22.78	5.63	26.15	45.43	100
IV Drug-Using Part.**	27.01	6.60	28.78	37.61	100
Prostitute**	22.54	3.58	28.05	45.83	100
Sex with Prostitute**	12.32	7.27	46.62	33.79	100
Sex with HIV+ Male	16.49	10.20	39.56	33.76	100
Has Other STI**	19.30	8.06	23.48	49.17	100
Non-Monogamous Part.**	22.23	12.49	22.76	42.53	100
Unprotected Sex**	21.70	10.46	23.02	44.82	100
Race:					
White**	30.21	16.95	26.87	25.97	100
Black**	28.73	5.60	24.63	41.04	100
Hispanic**	36.94	6.63	27.95	28.48	100
Other**	42.47	8.23	26.14	23.17	100
Marital Status:					
Married**	22.61	14.82	39.95	22.62	100
Cohabiting**	24.45	9.37	30.03	36.15	100
Previously Married**	22.07	7.33	24.20	46.41	100
Single**	48.15	14.20	9.10	28.55	100
Education:					
< High School**	53.51	5.08	18.19	23.21	100
High School Grad.*	29.46	12.02	29.61	28.91	100
> High School Grad.**	23.92	17.56	28.53	30.00	100
Place of Residence:					
Urban**	30.87	12.78	29.90	26.45	100
Suburban**	30.14	12.65	24.08	33.13	100
Rural**	36.82	16.34	22.63	24.21	100
Has Health Insurance**	32.56	14.57	26.91	25.96	100
Ever Been Pregnant **	20.53	11.00	38.56	29.91	100

* χ^2 $p < 0.10$ ** χ^2 $p < 0.05$

For marital status, the highest percentage of never having an HIV test was found for single women (48.17%). Previously married women had the highest percentage of having been tested apart from blood donation or pregnancy/routine testing, 46.41%. In the education categories, those with less than high school had the highest percentage of not having ever been tested (53.51%), with the highest rate of testing unrelated to blood donation or pregnancy/routine testing found in those with more than high school education (30.00%). Part of the relationship for education is likely due to the age of the sample, since the majority of women in the "less than high school" category are women who have not yet completed high school (that is, they are less than 18 years of age), rather than being "high school dropouts." Finally, women who have been pregnant at least once in their lifetime have a low prevalence of never being tested (20.53%) or blood donation (11.00%), and a relatively higher prevalence of testing related to pregnancy (38.56%). All bivariate distributions for the independent, "control" variables were significant at either the $p < 0.10$ level (high school graduate) or the $p < 0.05$ level (all other variables).

Logistic Regression Results

Following the descriptive analysis, I estimated 2 logistic regression models for each of 3 dependent variables. Table 3.4 reports the estimated effects in terms of odds ratio multipliers. The first set of 2 models uses any HIV test as the dependent variable. The first model uses only the risk factors as independent variables. In this model, sex with a prostitute, having a bisexual partner, and total number of sexual partners all significantly increased the odds of having an HIV test. When the additional independent variables are added to the model, having a non-monogamous partner and being a prostitute both become significant as well, although engaging in prostitution has a significantly negative effect. Both sex with a prostitute and total number of sexual partners retain significance in the presence of controls. Also significant in the full model was the "other" race variable, the previously married and single marital statuses, both education categories, rural residence, age and the "ever been pregnant" variable. For education, women with either less than high school or high school only were significantly less likely to have had any HIV test than were women with at least some college. Finally, women who had ever been pregnant were about 3 times as likely to have had any HIV test as were women who had never been pregnant. This relationship is as expected since this dependent variable includes women whose HIV test was due to pregnancy.

Table 3.4. Logistic Regression Results (ORs) for Three HIV Testing Outcomes

	Any HIV Test		HIV Test (excluding blood donation)		HIV Test (excluding blood donation and pregnancy/ routine)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Risk Factors:						
Involuntary Intercourse	1.16	1.02	1.43	1.21	1.03	1.05
Drug User	1.22	1.64	1.20	1.76**	1.80**	1.95**
Bisexual Part.	1.65*	1.75*	2.11**	2.09**	1.86**	1.75**
IV Drug-Using Part.	0.62	0.69	1.26	0.87	0.95	1.03
Prostitute	0.80	0.41**	1.26	0.67	1.58	1.18
Sex with Male Prostitute	7.38**	22.30**	3.68**	5.92**	0.77	0.84
Sex with HIV+ Male	0.60	0.49	0.54	0.66	0.78	0.76
Has Other STI	1.38	1.35	1.46*	1.42	1.58**	1.53**
Non-Monogamous Part.	1.16	1.53**	1.03	1.24	1.30**	1.06
Unprotected Sex	0.92	0.97	1.12	1.09	1.56**	1.26*
Total # of Sex Partners	1.13**	1.09**	1.08**	1.06**	1.04**	1.03**
Race:						
White		ref.		ref.		ref.
Black		1.14		1.81**		1.75**
Hispanic		0.91		1.21*		1.27**
Other		0.55**		0.94		0.97
Marital Status:						
Married		ref.		ref.		ref.
Cohabiting		0.92		1.02		1.55**
Previously Married		0.65**		0.84		1.72**
Single		0.61**		0.54**		1.47**
Education:						
< High School		0.37**		0.59**		0.65**
High School Grad.		0.54**		0.73**		0.81*
> High School Grad.		ref.		ref.		ref.
Place of Residence:						
Urban		ref.		ref.		ref.
Suburban		0.92		0.90		1.11
Rural		0.69**		0.60**		0.80*
Income		0.99		0.99		0.96**

Table 3.4. Continued

	Any HIV Test		HIV Test (excluding blood donation)		HIV Test (excluding blood donation and pregnancy/ routine)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Health Insurance		0.89		0.77**		0.75**
Age		0.97**		0.97**		1.02**
Ever Been Pregnant		3.52**		4.48**		0.90
Model Fit Statistics:[2]						
Unweighted Pseudo R^2	0.07	0.14	0.05	0.14	0.04	0.07
F-adjusted test statistic	61.80	2.33	86.50	2.55	21.12	2.46
p-value	$2.50 e^{-31}$	0.02	$3.00 e^{-36}$	0.01	$2.38 e^{-17}$	0.02
N	6487	6033	6487	6033	6487	6033

*p<0.10 ** p <0.05

[2] Strictly speaking, a pseudo R^2 statistic cannot be computed in a logistic regression model that takes into account the sample weights. These pseudo R^2 statistics are taken from an unweighted model for reference. A better measure of model fit that does take into account sample weights is the F-adjusted test statistic. For a complete discussion of model fit using sample weights, see Archer and Lemeshow 2006.

In the second set of 2 models, the dependent variable was HIV testing, excluding respondents whose sole HIV test was from donating blood. In this model, having a bisexual partner, sex with a prostitute, having another STI, and total number of sexual partners all significantly increased the likelihood of being tested for HIV, with all but having another STI retaining their significance in the presence of controls. In addition, the drug use variable becomes significant in the full model. Both the bisexual partner variable and the total number of sexual partners variable are of a similar magnitude in both models. For example, the results indicate that for each additional sexual partner a woman has in her lifetime she is 6% more likely to have been tested for HIV. Several of the additional independent variables are also significant in this model, including Black race, health insurance status, high school graduates, rural residence, age, and previous pregnancy. This model indicates that Black women are 81% more likely than White women to have been tested, and that women with health insurance are 23% less likely to have been tested than women who were not fully covered in the previous 12 months.

The final set of logistic regression results reported in Table 3.4 are the results when the dependent variable of HIV testing excludes tests related to blood donation, pregnancy, or other routine testing. This outcome seeks to represent the women who are actively seeking to be tested for HIV. In the initial model, risk factors that were found to significantly increase the odds of being tested were drug use, having a bisexual partner, having another STI, having a non-monogamous sexual partner, unprotected sex, and total number of sexual partners. In the presence of controls, the non-monogamous partner variable loses its significance, while the effects for the variables bisexual partner, unprotected sex, has other STI, and total number of sexual partners retain significance but experience a slight reduction in magnitude. Women who were drug users were found to be 95% more likely to have been tested than non-drug users. Also significant, but of lower magnitude, was the bisexual partner variable which indicated that women with a bisexual partner were 75% more likely to have been tested. This bisexual partner variable, along with the total number of sexual partners variable, was able to maintain significance across all three models.

Also of note in this final model was the relationship between the additional independent variables and the dependent variable. Women who were Black or Hispanic were significantly more likely to have had an HIV test than White women. This important relationship between race and HIV testing will be further explored in Chapter V of this dissertation. In the area of marital status, all other statuses were found to significantly increase the odds of being tested when compared to married women. Both income and health insurance status were found to be negatively related to the likelihood of being tested for HIV. Finally, the ever been pregnant variable loses significance, and changes in its direction of magnitude. This is to be expected since those women whose only HIV test was related to pregnancy have been excluded.

Discussion and Results of Hypothesis Testing

Overall, a comparison of all of these models indicates the importance of properly classifying the dependent variable. The significance and magnitude of effect for different risk factors changes dramatically depending on how the dependent variable is specified. As mentioned in the literature review, an important public health focus involves education measures that target population at risk to encourage individuals who know they are at risk to follow through and be tested for HIV. In order to more closely measure this relationship between risk and actively seeking to be tested, it is imperative that the dependent variable is specified as accurately as possible. It is also important to note that previous research that used the NSFG data to descriptively measure the relationship between risk and HIV testing only excludes testing related to blood donation from their classification of HIV testing, but does not exclude pregnancy or other routine testing. The results in this chapter indicate that, since the relationship between risk and HIV testing does differ based on the types of tests included, it is important that the type of testing being measured is clearly specified. In addition to this methodological exercise, this chapter was also seeking to test several substantive hypotheses. These hypotheses were:

H.1: Women who are at an increased risk of becoming infected with HIV due to having a known risk factor for the disease are hypothesized to also be more likely to actively seek to be tested for HIV.

H.2: Women who are at risk of developing HIV due to drug use are hypothesized to have a higher odds of receiving an HIV test than are women who are at risk due to sexual behavior.

My initial hypotheses was tentatively supported in my final model, with 5 out of 12 total risk factors maintaining significance in the presence of controls and when "passive" HIV testing has been excluded. It is important to note, however, that factors that represent a relatively high magnitude of risk, such as engaging in prostitution, having an IV drug-using partner, and especially, having an HIV+ partner, are all non-significant in the final model. The results presented in this analysis, then, seem to indicate that the likelihood of women with risk factors to be tested for HIV differs based on the risk factors she has. While several of these factors were significant in increasing the odds of being tested, for several of these key high risk factors, women who have them are no more likely to be tested than are women without the high risk factors. While it is possible that this is an accurate conclusion, there are other possible reasons for these non-significant findings that should be considered before reaching a conclusion.

One possible issue could be under-reporting of risk behavior. If respondents are not accurate in their reporting of risk, it can bias the resulting findings. Although misreporting is inevitable, the data collection process included numerous steps to increase the reliability of the data. A more important issue, however, is a concern about possible low statistical power in the logistic regression models. For several of the risk factors, a very low prevalence is reported in the data. For example, both the sex with prostitute variable and the sex with HIV+ male variable have a prevalence in the sample of less than 1%. Both of these variables, along with several others, are non-significant. While it is very possible that these variables truly have a non-significant result, it is also possible low statistical power resulting from inadequate variation in the independent variable "stacks the deck" against finding a statistically significant effect. The problem of low prevalence for key risk factors will be further examined in the following chapter, where I explore these non-significant variables and evaluate options for classifying the relevant independent variables. In the absence of significant error, the results presented in this analysis indicate that the likelihood of women with risk factors to be tested for HIV differs based on the risk factors she has.

My second hypothesis, however, was fully supported in the final model. As expected, drug users were significantly more likely to have been tested for HIV outside of blood donation or pregnancy than were non-drug users, and this variable had the highest odds ratio of all of the risk factors in the final model. The results I found in this chapter do provide some support for the idea that there is a "lag" in public perception of HIV risk due to heterosexual behavior in women.

CHAPTER IV

MEASURMENT OPTIONS FOR HIV RISK FACTORS

In this chapter I build on the findings of the previous chapter and explore whether different methods of classifying risk can lead to different conclusions regarding the relationship between risk and HIV testing. In the previous chapter, I noted concerns relating to the relatively low prevalence of several of the individual risk factors (both in the sample and in the population overall). For example, the risk factor "sex with an HIV + male," applies to less than 1 percent of the sample. This low prevalence can lead to low statistical power for assessing the relationship between each individual factor and HIV testing behavior, and could complicate conclusions about the true risk factor effects. In order to evaluate this further, the analysis I performed for this chapter examines several options for measuring and classifying risk. I then compare the results for alternative options for classifying risk to the original results obtained in the previous chapter.

Data and Methods

As in the previous chapter, this chapter utilizes the 2002 wave of the National Survey of Family Growth, and focuses only on the female dataset. The main focus of this chapter is to evaluate the difference in results when the independent variables related to risk factors are classified differently. Specifically, I compare the original logistic regression results from the previous chapter to logistic regression results obtained from several alternative models that use a different approach for measuring sexual risk factors. For each of these models, I present results with and without relevant control variables. In this chapter, I utilize only the third dependent variable used in the analysis presented in Chapter III: whether the respondent has had an HIV test that is unrelated to blood donation, pregnancy, or routine testing. As noted before, this is my main dependent variable of interest and represents the most accurate representation of "active" HIV testing.

The analysis discussed in this section begins with a descriptive analysis of the relevant variables for this section, followed by the logistic regression results. For each logistic regression model, I compute results with and without control variables to determine if risk factors that are initially significant remain significant in the presence of controls. Across models, I am able to compare the results to determine if the method of classifying risk makes a difference in the relationship between risk and HIV testing status. As in the previous chapter, I apply appropriate sample weights in my analysis and report the antilog of the logit coefficients (i.e. odds ratio multipliers) to aid interpretation.

Relevant Variables

The relevant variables for this chapter are the same as those utilized in the previous chapter. They include variables related to HIV testing behavior and known risk factors, as well as several additional variables that serve as controls. In this chapter, the dependent variable also remains the same for all four models. This dependent variable is the same outcome that was used in the final model for the previous chapter and measures HIV testing, excluding blood donation or pregnancy related testing. This variable is coded “0” if no HIV test is reported or if the respondent’s only reported HIV test was due to blood donation. It is also coded “0” if the respondent lists the reason for their HIV test as related to pregnancy or another “routine” HIV test.

Independent Variables – HIV Risk Factors

The risk factor variables examined in this chapter are created from the same initial variables that were used in the previous chapter. These variables include nine dummy variables that represent types of sexual risk, a dummy variable that measures drug use, and a continuous variable measuring the number of male sexual partners in a respondent’s lifetime. The goal of this chapter, in regards to these risk factor variables, is to evaluate the difference in results when risk is measured in different ways. For all models, the drug use variable and the number of lifetime male sexual partners variables are included as before. The measurement of sexual risk, however, is implemented in a different way in each of the models.

In the initial model, the results from the final model in the previous chapter are repeated. This version retains the initial method for classifying sexual risk as a series of nine separate dummy variables coded “1” if the respondent reports the presence of the risk factor and “0” if they do not. These nine dummy variables are:

- Involuntary Intercourse

- Bisexual Partner
- IV Drug Using Partner
- Prostitute
- Sex with a Male Prostitute
- Sex with an HIV+ Partner
- Has other STI
- Unprotected Sex
- Non-Monogamous Partner

These variables are included in the first model individually, along with the drug use variable and the number of lifetime male sexual partners variable.

As mentioned in the previous chapter, many of the individual sexual risk factors did not have a statistically significant effect on the likelihood of HIV testing. While this can indicate a truly non-significant relationship, one of the concerns with the nine sexual risk factor dummy variables is the relatively low statistical power of the test due to the low prevalence of these factors individually. One relatively simple method to address this concern is to combine these variables in to one, sexual risk variable. The second logistic regression model utilizes this method by creating a dummy variable where respondents are coded as "1" if they report *any* one of these nine sexual risk factor variables and "0" only if the respondent does not report any of these risk factors. This method conceptualizes sexual risk broadly, and evaluates whether or not respondents with this broadly defined sexual risk are more likely to be tested for HIV. This method increases the statistical power for statistical tests of the effects of the sexual risk variable based on the higher overall prevalence for this broad item in comparison to the previous individual ones.

While the combined sexual risk variable is a potentially useful way to measure risk, there are still some concerns with using such a broad variable. Although it does increase overall prevalence, it also masks potentially important differences between respondents in their risk status. The respondents that fall into the "sexual risk" category represent a diverse group of individuals, and the substantive "degree" of their actual risk is not uniform. Another, and potentially better, measure would take into account that different respondents coded "1" on the broad measure of risk might have significantly different levels of risk. One possible way to measure this is to build a variable that counts the number of risk factors that a respondent reports. In this way, the variable remains a combined sexual risk variable, but respondents who exhibit multiple risk factors would be assessed as having a higher level of risk than a respondent with only one. For the third model, I have created a continuous variable that gives the number of sexual risk factors reported by the respondents, ranging from 0 to 9. This model, then, would evaluate whether or not the likelihood of being tested for HIV increases as the number of risk factors increase.

The fourth approach extends this logic one step further by creating a scaled variable for sexual risk. While a simple count of the number of risk factors is a better measure of the level of risk than a simple dummy variable for sexual risk, it does not take into account the fact that these risk factors are inherently different in their level of risk. For example, having a non-monogamous partner may be reasonably viewed as less risky than having sex with a partner that is known to be HIV positive. By building a scale for level of sexual risk, both the number of risk factors and the level of risk that each factor represents can be taken into account. I create this sexual risk scale by assigning a “score” representing the level of risk to each of the individual sexual risk variables. The “score” assigned to each risk factor is as follows:

- Unprotected Sex = 1
- Non-Monogamous Partner = 1
- Has other STI = 2
- Involuntary Intercourse = 2
- Prostitute = 3
- Sex with a Prostitute = 3
- Sex with IV Drug-Using Partner = 4
- Bisexual Partner = 4
- Sex with HIV+ Male = 5

For each respondent, the value of the total sexual risk scale variable is calculated by adding up the score associated with each of the risk factors that they indicated having. Respondents with no risk factors have a value on the sexual risk scale of 0. The range for this sexual risk factor scale is from 0 (for individuals with no risk factors) to 25 (for individuals with all of the risk factors). In this way, sexual risk simultaneously reflects both the number of risk factors and the level of risk associated with those risk factors.

Independent Variables – Other

For the full models, including the additional control variables, the same list of additional independent variables are used in this chapter as were used in the previous chapter. These variables are operationalized in the same manner as they were previously. These variables are:

- Race/ethnicity – 4 dummy variable categories for race: White, Black, Hispanic, and Other.
- Marital Status – 4 dummy variable categories for marital status: Married, unmarried-cohabiting, previously married, and single.
- Education – 3 dummy variable categories for education: less than high school, high school graduate without college, and high school graduate with some college and above.
- Income – a continuous variable measured in 14 categories ranging from $5,000 per year to $75,0000+.
- Health Insurance – a dummy variable that indicates whether or not the respondent had been covered by health insurance for all of the previous 12 months.
- Place of Residence – 3 dummy variable categories for place of residence: urban, suburban, or rural.
- Age – the respondent's age in years.
- Ever been Pregnant – a dummy variable measuring if the respondent had ever been pregnant.

Descriptive Results

I present descriptive statistics for the relevant risk factor variables Table 4.1. Percentages reported in this table refer to the percent of the total sample reporting the risk behavior, using the appropriate sample weights. The results for individual risk factors are repeated from Chapter III. These results indicated that the prevalence of separate, individual risk factors ranged from a high of 9.37% for sex with a non-monogamous partner to a low of 0.58% for sex with a male known to be infected with HIV. Likewise, the prevalence of drug use, 3.20% of the total sample, remains the same from the previous chapter, as does the mean number of lifetime male sexual partners, at 5.63.

My main interest here is with the three new approaches to measuring risk. First, all sexual risk factors were combined into a single dummy variable that indicates whether or not the respondent reports any one of the nine sexual risk factor variables. For this variable, 22.70% of the sample reported at least one of the sexual risk factor variables. The second variable created from the sexual risk factors was a variable that counted the total number of risk factors reported by a respondent. This variable had a theoretical range from a low 0 (indicating the respondent reported none of the nine risk factors) to a high of 9 (indicating the respondent reported all of the nine risk factors). In the analysis, the respondents ranged from 0 to 8 on this variable. No respondent reported all nine risk factors. The mean number of risk factors reported was 0.34, a low value reflecting the large proportion of respondents that reported no risk factors (77.3%).

Table 4.1. Descriptive Results, Risk Factor Variables

	Percent	Mean	Standard Deviation
Individual Risk Factors:			
Involuntary Intercourse	4.68	---------	---------
Bisexual Part.	2.51	---------	---------
IV Drug-Using Part.	3.19	---------	---------
Prostitute	2.06	---------	---------
Sex with Prostitute	0.95	---------	---------
Sex with HIV+ Male	0.58	---------	---------
Unprotected Sex	9.14	---------	---------
Has Other STI	3.40	---------	---------
Non-Monogamous Part.	9.37	---------	---------
Drug User	3.20	---------	---------
Number of Risk Factors:		---------	---------
No Risk Factors	77.30	---------	---------
1 Risk Factor	15.32	---------	---------
2 + Risk Factors	7.38	---------	---------
Any Sexual Risk Factor	22.70	---------	---------
Number of Risk Factors (range 0-8)	---------	0.34	0.02
Number of Sex Part.	---------	5.63	0.13
Sexual Risk Scale (range is 0-23)	---------	0.66	0.03

Note: Since these results are weighted to take into account the NSFG sample design, these are linearized standard errors, rather than standard deviations. The actual standard deviations for unweighted versions of these variables are substantially higher.

Respondents who reported the presence of sexual risk factors were most likely to report only one risk factor, with 15.32% reporting one of the nine factors, and only 7.38% reporting two or more risk factors. The final risk factor variable reported here is the sexual risk scale variable. This variable had a theoretical range from a low of 0 (indicating the respondent reported no sexual risk) to a high of 25 (indicating the respondent reported all of the risk factor variables for the maximum level of sexual risk). In the analysis, the respondents ranged from 0 to 23 on this variable, again reflecting that no respondents reported all 9 risk factors. The mean score on the sexual risk scale was 0.66, once more a low value that is reflective of the large number of respondents reporting no sexual risk factors.

Following this univariate descriptive analysis, I also calculated a bivariate cross tabulation of the appropriate relevant risk factor variables for each of the categories of HIV testing. These results are presented in Table 4.2. In this table, percentages total across the rows. Percentages are calculated for respondents coded "1" for each of the dummy variable categories. As noted in the previous chapter, the highest percentage of "other" HIV tests was for respondents who reported drug use (50.11%) or having another STI (49.17%). The risk factor with the lowest HIV testing rate was involuntary intercourse, with 23.23% of respondents with this risk factor reporting no HIV test and only 31.59% of these respondents falling into the "other" HIV testing category.

In addition to these previously reported results, I also performed a bivariate analysis of two of the new sexual risk factor variables introduced in this chapter. The sexual risk scale variable is not included in this analysis since it is a continuous and not categorical variable. The majority respondents with the sexual risk variable, which is the dummy variable indicating whether or not the respondent reported any one of the sexual risk factors, did indicate that that they have received at least some type of HIV test, with 19.80% indicating no HIV test. Of those reporting some type of HIV test, 27.50% reported an "Other" HIV test.

Following this analysis, I also performed a bivariate analysis of the number of risk factors variable and the HIV testing categories. In order to include the number of risk factors variable in a bivariate cross-tabulation, I have conceptualized this as a 3 category variable: no risk factors reported, one risk factor reported, and 2 or more risk factors reported. This variable is only categorized this way for the purposes of cross-tabulation. In the logistic regression section, this variable is included in the analysis as a continuous variable. For respondents with no risk factors, 33.11% reported no HIV test, with the largest percentage falling in the Pregnancy Related or Other Routine Test category. A larger percentage of respondents with one risk factor were in the "Other" testing category (40.16%), and this percentage increased slightly for those with two or more risk factors (41.35%). A χ^2 analysis of these results indicated that this distribution was statistically significant.

Table 4.2. Descriptive Results, Percent Distribution of Each Testing Category Comparison of Sexual Risk and Drug Use

	No HIV Test	Blood Donation	Pregnancy Related or Routine Test	Other HIV Test	Total
Sexual Risk (any factor)**	19.80	13.63	28.79	27.50	100
Number of Risk Factors:					
No Risk Factors**	33.11	14.54	28.69	23.67	100
One Risk Factor Only**	18.53	10.61	30.70	40.16	100
Two or More Risk Factors**	22.44	10.35	25.86	41.35	100
Individual Risk Factors:					
Involuntary Intercourse*	23.23	10.59	34.59	31.59	100
Bisexual Part.**	22.78	5.63	26.15	45.43	100
IV Drug-Using Part.**	27.01	6.60	28.78	37.61	100
Prostitute**	22.54	3.58	28.05	45.83	100
Sex with Prostitute**	12.32	7.27	46.62	33.79	100
Sex with HIV+ Male	16.49	10.20	39.56	33.76	100
Has Other STI**	19.30	8.06	23.48	49.17	100
Non-Monogamous Part.**	22.23	12.49	22.76	42.53	100
Unprotected Sex**	21.70	10.46	23.02	44.82	100
Drug User**	21.93	10.28	17.68	50.11	100

* χ^2 $p < 0.10$ ** χ^2 $p < 0.05$

Logistic Regression Results

In this section, I present results from logistic regression models using different approaches to measuring risk. These results are presented in Table 4.3. For each set of models, I first estimate a model with risk factors only, and then evaluate the relationship between risk and testing status with controls included. All models are estimated for the dependent variable of HIV testing status excluding blood donation and pregnancy related or routine testing. The first set of two models repeats the results from the previous chapter where sexual risk was assessed using nine individual dummy variables. As described before, the risk factors that are significant initially are drug use, having a bisexual partner, having another STI, having a non-monogamous sexual partner, unprotected sex, and total number of sexual partners. In the presence of controls, however, the non-monogamous partner variable loses significance.

In addition to these independent variables, I discussed the effects of the control variables in Chapter III. To briefly summarize, women who were Black or Hispanic were significantly more likely to have had an HIV test than White women. In the area of marital status, all other statuses were found to significantly increase the odds of being tested when compared to married women. Both income and health insurance were found to be negatively related to the likelihood of being tested for HIV.

Table 4.3. Logistic Regression Results (ORs) for 4 Risk Measurement Options

	Individual Risk Factors		Any Risk Factor Variable		Number of Risk Factors Variable		Sexual Risk Scale Variable	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Individual Sexual Risk Factors:								
Involuntary Intercourse	1.03	1.05						
Bisexual Part.	1.86**	1.75**						
IV Drug-Using Part.	0.95	1.03						
Prostitute	1.58	1.18						
Sex with Male Prostitute	0.77	0.84						
Sex with HIV+ Male	0.78	0.76						
Has Other STI	1.58**	1.53**						
Non-Monogamous Part.	1.30**	1.06						
Unprotected Sex	1.56**	*1.26*						
Any Sexual Risk Factor	---------	---------	1.77**	1.42**	---------	---------	---------	---------
Number of Risk Factors	---------	---------	---------	---------	1.28**	1.15**	---------	---------
Sexual Risk Scale	---------	---------	---------	---------	---------	---------	1.07**	1.04**
Total # of Sex Partners	1.04**	1.03**	1.04**	1.03**	1.04**	1.03**	1.04**	1.04**
Drug User	1.80**	1.95**	1.95**	2.00**	1.97**	2.02**	2.12**	2.09**
Race:								
White		ref.		ref.		ref.		ref.
Black		1.75**		1.74**		1.74**		1.75**
Hispanic		1.27**		1.29**		1.28**		1.28**
Other		0.97		0.92		0.91		0.91
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.55**		1.54**		1.55**		1.56**
Previously Married		1.72**		1.67**		1.72**		1.77**
Single		1.47**		1.46**		1.49**		1.52**
Education:								
< High School		0.65**		0.65**		0.65**		0.65**
High School Grad.		0.81*		0.81*		0.81*		0.80*
> High School Grad.		ref.		ref.		ref.		ref.

Table 4.3. Continued

	Individual Risk Factors		Any Risk Factor Variable		Number of Risk Factors Variable		Sexual Risk Scale Variable	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.11		1.10		1.11		1.11
Rural		0.80*		0.79*		0.79*		0.79*
Income		0.96**		0.96**		0.96**		0.96**
Health Insurance		0.75**		0.76**		0.75**		0.75**
Age		1.02**		1.02**		1.02**		1.02**
Ever Been Pregnant		0.90		0.90		0.91		0.91
Model Fit Statistics:								
Unweighted Pseudo R^2	0.040	0.070	0.042	0.071	0.038	0.069	0.035	0.069
F-adjusted test statistic	21.12	2.46	18.54	2.15	25.54	2.88	24.85	2.98
p-value	2.38 e^{-17}	0.02	6.70 e^{-16}	0.04	1.41 e^{-19}	0.006	3.03 e^{-19}	0.004
N	6487	6033	6487	6033	6487	6033	6487	6033

*p < 0.10 ** p < 0.05

In the second set of logistic regression models, sexual risk is measured using a dummy variable scored “1” if the respondent has any of the nine sexual risk factors. The first model contains this combined sexual risk variable in addition to the drug use and total number of sexual partners variable. All three of these variables are significant and positive in this model. Having any sexual risk factor was found to increase the likelihood of having been tested for HIV by 77%. More importantly, this variable maintains significance in the presence of controls, continuing to increase the likelihood of being tested for HIV by 42%. The total number of sexual partners variables remains significant and of similar magnitude in this model as well. The third set of logistic regression models utilizes a count variable for capturing sexual risk. This variable simply gives the number of sexual risk factors that an individual respondent has. In the first model, this variable is significant, indicating that for every additional risk factor a woman has, her likelihood of being tested for HIV is increased by 28%. This variable is also significant in the full model, although is less in magnitude with an odds ratio of 1.15, indicating that, for each additional risk factor a woman is 15% more likely to have been tested for HIV. The additional risk factor variables of total number of sexual partners and drug use remain similar to results seen in previous models.

In the final set of models, sexual risk is categorized using the sexual risk factor scale. This scale takes into account both the number of risk factors a respondent has and the level of risk associated with those particular risk factors. In the first model, this variable is significant with a value of 1.07, indicating that for each increase in the sexual risk scale, the likelihood of being tested for HIV increases by 7%. In the full model, which includes relevant control variables, this variable decreases slightly in magnitude, indicating that each increase in the sexual risk scale increases the likelihood of being tested by 4%. While this does indicate that women at the highest point of the scale (a value of 25 indicating that they have all of the relevant risk factors) are 166% more likely to have been tested that women with no risk factors, differences between women with less extreme variation are minimal.

In order to compare across models, I also calculated measures of model fit. The most common measure of model fit for logistic regression, the Pseudo R^2, is unable to be computed using a model that takes the sample design effects into account, however I have included Pseudo R^2 results calculated from an unweighted model for comparison. Interestingly, according to the Pseudo R^2, the model that represents the best fit is the model with the single combined sexual risk variable (Pseudo R^2 of 0.071). Both the model with the number of sexual risk factors variable and the sexual risk scale variable had lower Pseudo R^2 statistics than the initial model with all variables represented individually. These results are similar when assessing model fit using the F-adjusted test statistic, which is a measure that takes into account adjustments for survey design. This statistic tests the null hypothesis that the model *is* a good fit, so that rejecting the null hypothesis for this statistic indicates that the model is *not* a good fit. For all of these models, the null hypothesis is rejected, however the model with the highest p-value is also the one with the largest Pseudo R^2, also indicating that the model with the combined sexual risk variable is the model with the best fit.

A Further Exploration of the Logistic Regression Results

As I have noted in Chapter III, when a problem with low power arises I cannot fully rule out a relationship between risk factors and HIV testing solely on the basis of non-significant results. While the relationship between these risk factors and HIV testing may in fact be non-significant, it is also possible that these findings are a result of low statistical power, rather than a reflection of a substantively non-significant relationship. In the models I presented above, I sought to increase statistical power to further evaluate the relationship between risk and HIV testing. In all of these models I did find evidence of a significant relationship between risk, broadly specified, and the likelihood of HIV testing. It is possible, however, that the significance of these combined risk factor variables is the result of the same variables that were significant before. In order to more fully assess the impact of the previously, non-significant variables in these models, I estimated two follow-up models to try to more fully explain the way that risk is related to HIV testing.

In the first of these two follow-up models, I kept the individual risk factor variables that were initially significant as individual dummy variables. For the non-significant variables, I created a combined variable that was coded "1" if the respondent reported any one (or more) of these risk factors, and "0" if the respondent did not report any of these risk factors. The variables that were not significant in the initial model were: involuntary intercourse, non-monogamous sexual partner, engaging in prostitution, sex with a male prostitute, sex with an HIV+ male, and sex with an IV drug user. The percentage of respondents coded as "1" on this follow up variable was 16.68%, which was substantially higher than any of the risk factors individually. I present the results of this follow-up model in Table 4.4.

In the model utilizing a variable that combined all initially non-significant variables I found that this variable was initially significant, but lost significance in the presence of control variables. This indicates that even when increasing the statistical power of these variables, there is not a significant relationship between these risk factors (as a combined variable) and the likelihood of being tested. These findings provide support for a truly non-significant effect of these sexual risk factors, and indicate that the significant effect found with the previous models using a combined, sexual risk factor variable was most likely the result of the significant effects of the same variables that were significant in the initial models.

Table 4.4: Additional Logistic Regression Results (ORs)

	Combined, “non-significant” Risk Factor Variable			High Risk Sex Variable	
	Model 1	Model 2		Model 1	Model 2
Bisexual Part.	1.84**	1.72**	Bisexual Part.	1.85**	1.75**
Has Other STI	1.73**	1.71**	Has Other STI	1.60**	1.54**
Unprotected Sex	1.59**	1.31**	Unprotected Sex	1.55**	1.25*
Total # of Sex Partners	1.04**	1.03**	Total # of Sex Partners	1.04**	1.03**
Drug User	1.70**	1.81**	Drug User	1.82**	1.94**
			Involuntary Intercourse	1.03	1.06
Combined, “NS” Risk Factors	1.22**	1.04	Non-Monogamous Part.	1.30**	1.06
			High Risk Sex	1.08	0.97
Race:			*Race:*		
White		ref.	White		ref.
Black		1.77**	Black		1.75**
Hispanic		1.24**	Hispanic		1.26**
Other		0.91	Other		0.90
Marital Status:			*Marital Status:*		
Married		ref.	Married		ref.
Cohabiting		1.54**	Cohabiting		1.55**
Previously Married		1.69**	Previously Married		1.71**
Single		1.48**	Single		1.48**
Education:			*Education:*		
< High School		0.67**	< High School		0.65**
High School Grad.		0.81*	High School Grad.		0.80*
> High School Grad.		ref.	> High School Grad.		ref.
Place of Residence:			*Place of Residence:*		
Urban		ref.	Urban		ref.
Suburban		1.11	Suburban		1.10
Rural		0.81	Rural		0.80*
Income		0.97**	Income		0.96**
Health Insurance		0.74**	Health Insurance		0.74**
Age		1.02**	Age		1.02**
Ever Been Pregnant		0.91	Ever Been Pregnant		0.91

Table 4.4: Continued

	Combined, "non-significant" Risk Factor Variable		High Risk Sex Variable	
	Model 1	Model 2	Model 1	Model 2
Model Fit Statistics:				
Unweighted Pseudo R^2	0.04	0.07	0.04	0.07
F-adjusted test statistic	21.23	3.20	23.69	3.69
p-value	$2.07\ e^{-17}$	0.002	$1.11\ e^{-18}$	0.001
N	6549	6084	6488	6034

*p <0.10 ** p < 0.05

In this follow up model I was attempting to further to explore the statistical effects of the variables found to be non-significant. However, it does not make sense, substantively, to combine some of these variables since they do not represent a similar level of risk. In order to explore these non-significant variables in a model that is more substantively logical, I created a variable that combines the variables that represent the highest magnitude of risk into a "high risk sex" variable. These variables were also the variables with the lowest prevalence in the sample. This "high risk sex" variable included both prostitution variables, sex with an HIV + male and sex with a male IV drug user. Respondents were coded "1" if they reported any one of these factors and "0" if they reported none of these factors. This resulted in 4.09% of respondents coded "1" on this variable. The variables measuring unprotected sex, sex with a non-monogamous partner, sex with a bisexual male, involuntary intercourse, drug use and other STI all remain in the model as individual variables.

I also present the results of this additional model in Table 4.4. In this model, I found similar results to the previous model. The high risk sex variable was not found to be significant. In fact, when controls are added, this variable was not even in the expected direction. Additionally, the variables involuntary intercourse and non-monogamous partner remain non-significant in this model as well.

Discussion and Results of Hypothesis Testing

The results of the analysis presented in this chapter highlight the important difference that measurement approach can have on logistic regression results. These results were obtained in order to test my third hypothesis:

> **H.3:** Due to the multi-faceted nature of HIV risk, the relationship between having known risk and testing behavior will be different depending on the method used for measuring HIV risk.

In the initial models, I found very little relationship between sexual risk factors and HIV testing. Since the prevalence of each individual factor is relatively low, this can influence the statistical power of each variable and make any "true" relationship harder to detect. The goal in this chapter was to find a way to overcome this problem and thereby better assess the relationship between risk and HIV testing.

The relationship between the total number of sexual partners variable, the drug use variable and HIV testing remained constant throughout all models, which is as expected since these variables were unchanged. The broadly defined "sexual risk" variable(s) are different in their impact across all models. Although the first model is the ideal analysis, the finding of more significant results in the other models indicates that the issue of the low prevalence could be decreasing the confidence of these results, especially "null" results under conditions of low prevalence. In the second model, the finding of a significant relationship between sexual risk and HIV testing is a substantively important result, however the rough nature of this variable makes it still an imperfect solution. A more complete measurement of sexual risk is created in the third and fourth models, which turns the sexual risk variable into a continuous variable. Both the third and fourth models also indicate a significant relationship between sexual risk and HIV testing. These findings initially provided support for my third hypothesis, however the results of my "follow-up" models seem to indicate that the significant findings for the broadly specified sexual risk variables is most likely the result of the same factors that were significant initially.

The substantive findings of this chapter indicate a significant effect of broadly defined risk on the likelihood of HIV testing, however the evidence suggests that the significant effects continue to be the result of the same few variables. This indicates that, while in some cases there is a significant effect of risk on the likelihood of HIV testing, other, important variables are still not increasing the likelihood of testing. In addition, when significant relationships between sexual risk and testing are found the magnitude of these relationships remain low. These results continue to indicate an important area for public health initiatives focused on encouraging women to be tested for HIV. The substantive importance of these results will be further discussed in the final chapter of this dissertation.

CHAPTER V

THE RELATIONSHIP BETWEEN RISK, RACE, AND HIV TESTING

In this chapter, I further explore the relationship between risk and HIV testing by determining how this relationship varies by race or ethnic status. It has been well established in previous research that the prevalence of HIV in the United States differs significantly across racial status. In particular, African American women are disproportionately impacted by the disease. While it is important for any woman with risk factors to be tested for the disease, the heightened prevalence of HIV in this population makes it especially imperative for public health efforts to target African American women. While the results of the previous chapter provide support for the hypothesis that women with risk for contracting the disease are more likely to seek to be tested than women who are not at risk, it is also important to note whether or not this relationship remains when focusing on key population groups. To accomplish this, I build upon the results found in the previous two chapters by examining these relationships within race/ethnic groups.

Data and Methods

This chapter utilizes the same data source as the previous chapters, which is the 2002 National Survey of Family Growth. The key focus in this chapter is to examine the differences in the relationship between risk and HIV testing for women of different race/ethnic groups. While the analysis I performed in the previous chapters does include race as an independent variable, the substantive importance of race when evaluating HIV testing necessitates a closer look at this relationship. To accomplish this, I first perform separate logistic regression models by race. Following this by-race analysis, I perform a pooled logistic regression model that includes an interaction term for race and relevant risk variables. By performing this analysis both ways I can cross-check these results to ensure that results from the separate, race-specific analyses are not influenced by low statistical power.

The NSFG data permits me to consider four distinct groups: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Other. For the remainder of this chapter, “Non-Hispanic White” and “Non-Hispanic Black” groups are referred to as simply “White” and “Black.” The “Other” group is not further specified in the data, making analysis of this category difficult. In addition, the “other” group is the smallest group in the dataset, comprising only 5.53% of the sample. Because of this, I have chosen not to conduct a separate logistic regression of this population.

For White, Black, and Hispanic groups, I conduct a logistic regression analysis using the same dependent variable utilized in Chapter IV, which was whether the respondent has had an HIV test that is unrelated to blood donation, pregnancy, or routine testing. I also compare models both with and without the presence of relevant control variables, and compare by-race results with the results found previously in the full population models to determine if the results for the full population are also seen in the individual racial groups. I also include all appropriate sample weights and report the antilog of the logit coefficients to aid interpretation.

Relevant Variables

For this chapter, I had several choices for conceptualizing risk as an independent variable. As discussed in the previous chapter, there is a difference in the relationship between risk and HIV testing status, depending on the way risk is measured. In this chapter, I focus primarily on this scaled risk variable, however I have also repeated results by race using all methods of conceptualizing risk (i.e. individual risk factor variables, number of risk factors, a dichotomous “sexual risk” variable, and the “high risk sex” variable plus remaining individual factors) to ensure that the relationship between risk and HIV testing by race is fully explored. To review, the individual risk factor variables include the following nine variables, coded as dummy variables:

- Rape
- Bisexual Partner
- IV Drug Using Partner
- Prostitute
- Sex with a Male Prostitute
- Sex with an HIV+ Partner
- Has other STI
- Unprotected Sex

- Non-Monogamous Partner

Using these individual risk factor variables, I have also created a scaled variable that takes into account both the number of risk factors and the magnitude of risk associated with each one. This scale variable is included in the main logistic regression results reported in this chapter. For the purposes of comparison, I have also included results utilizing the risk variables that measure the number of risk factors reported, a dummy variable measuring whether the respondent reports any risk factor, and a model with a "high risk sex" variable along with remaining individual risk factors. The logistic regression results for these additional models are presented in the Appendix. Finally, all analyses include the two additional risk factor variables that measure drug use as a dummy variable, and the total number of sexual partners as a continuous variable.

In addition to these main, risk factor variables, the analyses also include additional independent variables as controls. These control variables are also the same variables included in the previous two chapters. These variables are:

- Marital Status – 4 dummy variable categories for marital status: Married, unmarried-cohabiting, previously married, and single.
- Education – 3 dummy variable categories for education: less than high school, high school graduate without college, and high school graduate with some college and above.
- Income – a continuous variable measured in 14 categories ranging from $5,000 per year to $75,0000+.

- Health Insurance – a dummy variable that indicates whether or not the respondent had been covered by health insurance for all of the previous 12 months.
- Place of Residence – 3 dummy variable categories for place of residence: urban, suburban, or rural.
- Age – the respondent's age in years.
- Ever been Pregnant – a dummy variable measuring if the respondent had ever been pregnant.

Descriptive Results

The first portion of the results I present in this chapter are the descriptive results. Table 5.1 presents the prevalence of each categorical independent variable by race. This table includes results for several of the measurement options for risk, with the results for all groups included as a comparison. In addition, for each independent variable I tested for significant differences by race using a χ^2 statistic. For most of these variables, the results found for "all groups" masks a noteworthy contrast in the results by race. For the dummy variable that measures the presence of any one of the sexual risk factors, the overall prevalence for all groups was 22.70% reporting at least one sexual risk factor, however only 20.85% of White respondents reported at least one risk factor compared to 34.57% of Black respondents. Hispanic respondents had a prevalence closer to, and slightly lower than, White respondents (20.50%). Likewise, a closer look at the number of risk factors variable indicates that Black respondents are not only more likely than White and Hispanic respondents to have at least one sexual risk factor, but are nearly twice as likely to have two or more risk factors. For the variable measuring high risk sex (a compilation of 4 individual risk factors), 9.20% of Black respondents reported one of these four risk factors compared to 3.53% of Hispanic respondents and 3.11% of White respondents. All of these differences by race were found to be significant at the $p<.05$ level.

In addition to these broad sexual risk factor variables, I also took a closer look at the individual risk factor variables. These variables are also reported in Table 5.1. There are several notable distinctions by race in these individual risk factors. For almost all risk factor variables, Black respondents report remarkably higher prevalences. For example, the variable indicating sex with an HIV + male, arguably the variable indicating the highest risk, has a prevalence of 1.33% for Black respondents. While this is a relatively low prevalence, it is nearly quadruple the prevalence found for White respondents, 0.37%, and this difference is statistically significant. Similarly high differences are found for the variables representing engaging in prostitution. I found an exception to these distributions, in the variable representing Drug Use, where 3.31% of White respondents reported this factor compared to only 1.90% of Blacks.

Table 5.1. Descriptive Results, Percent Distribution of Each Categorical Variable by Race/Ethnicity

	All Groups	White	Black	Hispanic
Any Sexual Risk Factor**	22.70	20.85	34.57	20.50
High Risk Sex**	4.05	3.11	9.20	3.53
Number of Risk Factors:				
No Risk Factors**	77.30	79.15	65.43	79.50
One Risk Factor**	15.32	14.45	22.26	13.88
2+ Risk Factors**	7.38	6.40	12.31	6.62
Individual Risk Factors:				
Involuntary Intercourse	4.68	4.75	3.97	4.28
Bisexual Part.**	2.51	2.03	3.55	2.85
IV Drug-Using Part.**	3.19	2.63	6.82	2.48
Prostitute**	2.06	1.67	4.55	1.39
Sex with Prostitute**	0.95	0.70	2.14	0.82
Sex with HIV+ Male**	0.58	0.37	1.33	0.42
Unprotected Sex**	9.14	8.65	13.12	8.05
Has Other STI**	3.40	2.71	5.49	4.15
Non-Monogamous Part.**	9.37	8.53	16.98	6.72
Drug User**	3.20	3.31	1.90	3.05
Marital Status:				
Married**	45.97	50.55	25.51	45.51
Cohabiting**	9.08	8.03	9.47	13.45
Previously Married	9.89	9.57	12.02	9.91
Single**	35.06	31.86	53.00	31.13
Education:				
< HighSchool**	20.92	16.01	24.44	41.37
HighSchool Grad.*	27.97	27.55	32.26	28.28
>HighSchool Grad.**	50.80	56.26	43.03	29.60
Place of Residence:				
Urban**	49.00	51.90	38.45	48.50
Suburban**	33.31	25.78	53.78	45.17
Rural**	17.68	22.31	7.77	6.32
Ever Been Pregnant**	65.69	63.38	72.29	72.21
Health Insurance**	77.04	80.49	74.45	62.57

Note: The high risk sex variable is coded “1” if respondents report prostitution, sex with a male prostitute, an IV drug-using partner, or sex with an HIV + male partner.

* χ^2 $p < 0.10$ (percent differences by race)** χ^2 $p < 0.05$ (percent differences by race)

Black respondents also reported a lower prevalence of Involuntary Intercourse (3.97% of Black respondents compared to 4.75% of Whites), however these differences were not found to be significant. Hispanic respondents, for the most part, had prevalence levels of risk that were very similar to that for White respondents, with two notable exceptions. The variable "has other STI," had a prevalence for White respondents of 2.71%, while Hispanic respondents had a prevalence of 4.15%. This was a significantly higher prevalence of STIs than White respondents, but still lower than the prevalence of 5.49% found for Black respondents. With the exception of Involuntary Intercourse, all differences in percent distribution in risk factors were significant at the $p<.05$ level.

In Table 5.1, I also present the descriptive results for the additional, control variables. This includes the variables that represent marital status, education, place of residence, pregnancy, health insurance, age, and income. For marital status, White respondents had the highest percent currently married, 50.55%, while Black respondents had about half that rate, 25.51%. Hispanic respondents were in between, at 45.51% currently married. Hispanic respondents had the highest percent of cohabitation, while Blacks had the highest rates of being previously married (i.e. divorced, widowed, or separated) and currently single (53.00%). By-race differences in percent married, cohabiting, and single were all significant at the $p<.05$ level, however differences in percent previously married were not significant. In the category of education, Hispanic respondents had the highest rate of less than high school education (41.37% of Hispanics), Blacks had the highest rate of high school only (32.26%), and Whites had the highest percentage of at least some college (56.26% of White respondents), and these differences were significant.

Just over half of Whites reported living in an Urban area (51.90%), while just over half of Blacks reported living in a suburban area (53.78%). Hispanics were about evenly split between Urban and Suburban residence, and the largest percentage of rural residents was White (22.31% of White respondents). For previous pregnancy, White respondents had the lowest rate of at least one previous pregnancy (63.38%), with Black and Hispanic respondents having similar percentages, 72.29% and 72.21%, respectively. 80.49% of White respondents reported health insurance coverage for the all of previous 12 months, followed by 74.45% of Black respondents, and 62.57% of Hispanic respondents. With the exception of the “previously married” marital status, all percent differences by race were statistically significant.

In Table 5.2 I report the by-race distribution of continuous independent variables. These variables include the risk factor variables representing the total number of risk factors reported, the score on the sexual risk scale, and the total number of sexual partners. Continuous independent control variables include age and income. For all of these variables I used an ANOVA calculation to determine if mean differences were significant across race. For the total number of sexual partners variable, I found that Hispanic respondents reported a average of 3.43 partners, compared to 6.17 reported by White respondents and 5.95 reported by Black respondents. Mean differences in total number of sexual partners were significant between Whites and Hispanics and between Hispanic and Black respondents, however the mean difference between Whites and

Blacks was not significant. For the number of risk factors variable, all groups combined have a mean of 0.34, while White and Hispanic respondents have a mean of 0.31 and 0.30, respectively (a non-significant difference). This compares to a considerably higher mean of 0.54 for Black respondents, which was significantly different from the mean for White and Hispanic respondents. A look at the sexual risk factor scale provides similar results, where I find a mean on this scale variable for Black respondents that is nearly twice the mean found for White and Hispanic respondents. Likewise, the mean difference on the sexual risk scale variable is not significant between Whites and Hispanics, but is significant for other comparisons.

Finally, Table 5.2 also includes the differences by race for two independent control variables, income and age. In the area of income, White respondents had the highest mean income (10.03, representing the $35,000-$39,999 category), followed by Black respondents (7.98, representing the $25,000-$29,000 category), and Hispanic respondents (7.53, representing the $25,000-$29,000 category). Income differences between Black and Hispanic respondents were not significant, while all other comparisons were significant. For age, White respondents reported a slightly higher mean age (30.43) than Black respondents (29.43) or Hispanic respondents (28.92). The difference in mean age between White and Black respondents was not significant, while other mean differences were found to be significant.

Table 5.2. Descriptive Results by Race for Continuous Variables

	All Groups		White		Black		Hispanic	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Risk Factor Variables:								
Total # of Sexual Partners**	5.63	0.13	6.17	0.17	5.95	0.24	3.43	0.18
Number of Risk Factors**	0.34	0.02	0.31	0.02	0.54	0.03	0.30	0.02
Sexual Risk Scale**	0.66	0.03	0.58	0.04	1.09	0.07	0.58	0.05
Age**	29.97	0.17	30.43	0.24	29.43	0.34	28.92	0.29
Income**	9.34	0.08	10.03	0.11	7.98	0.17	7.53	0.18

**All ANOVA F-Statistic results by race are significant at the $p < 0.05$ level

Table 5.3. Tabulation of Race by Type of HIV Test

Race	No Test	Blood Donation	Pregnancy Related	Other HIV Test	Total
White	30.21	16.95	26.87	25.97	100
Black	28.73	5.60	24.63	41.04	100
Hispanic	36.94	6.63	27.95	28.48	100

Note: $\chi^2 = 219.22$, $p < 0.05$

The final portion of the descriptive results is presented in Table 5.3. In this table, I present a bivariate, cross-tabulation of the distribution of type of HIV test by race. Hispanic respondents were found to have the highest percent with no HIV test at all, with 36.94% reporting that they have never been tested. Black respondents had the lowest rate of no HIV tests (28.73%), and, conversely, the highest rate of at least some type of test. Additionally, Black women had the highest rate of "other" HIV tests, with 41.04% reporting that they had been tested apart from blood donation, pregnancy, or routine testing. Hispanic and White women had a similar prevalence of "other" HIV tests, and all three groups had similar levels of pregnancy related-only tests. Finally, in the area of blood donation only tests, White women had a substantially higher percent of these tests than Black or Hispanic women: 16.95% of White women compared to 5.60% and 6.63% for Black and Hispanic women, respectively. These results were statistically significant at the $p < 0.05$ level using a chi square statistic.

Logistic Regression Results

In Table 5.4 I present the results of the logistic regression analysis for these data. In this analysis, the dependent variable is whether or not the respondent has received an HIV test other than blood donation, pregnancy, or routine testing. For the measurement of sexual risk, I have used the sexual risk scale variable, created from the individual sexual risk factors and using weights for magnitude of risk. Other risk factors included are drug use and total number of sexual partners. The first column repeats the analysis presented in Chapter IV for all races combined, first with risk factors only and then with relevant controls. The next three columns then present the results separately for each group: White, Black and Hispanic.

As a review, I found in Chapter IV that with all races combined all three risk factor variables were significant, and remained so in the presence of controls. This indicates that for each increase in the sexual risk factor scale, the likelihood of being tested increased by 4%. Additionally, both drug use and the total number of sexual partners also significantly increased the likelihood that a woman would be tested for HIV. These results provided support for the hypothesis that women with a higher risk for HIV were in fact more likely to be tested, a desirable outcome from a public health standpoint. Additionally, I found in the initial model that Black respondents were 75% more likely to be tested than White respondents, also a desirable outcome, given their disproportionate rate of infection. The results for the by-race logistic regression models indicate that the relationship between risk and testing is more complex than the initial results suggest, however.

Table 5.4. Logistic Regression Results (ORs) for HIV Testing, all Races and By Race

	All Races		White		Black		Hispanic	
	Model 1	Model 2	*Model 1*	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
Risk Factors:								
Sexual Risk Scale	1.07**	1.04**	1.07**	1.05*	1.04*	1.03	1.06	1.04
Drug Use	2.12**	2.09**	2.21**	1.85**	1.65	2.13*	1.97*	2.33**
Total # Part.	1.04**	1.04**	1.04**	1.04**	1.04**	1.04**	1.05**	1.04**
Race:								
White		ref.	---------	---------	---------	---------	---------	---------
Black		1.75**	---------	---------	---------	---------	---------	---------
Hispanic		1.28**	---------	---------	---------	---------	---------	---------
Other		0.91	---------	---------	---------	---------	---------	---------
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.56**		1.45**		2.34**		1.30*
Previously Married		1.77**		1.75**		2.30**		1.63**
Single		1.52**		1.31		2.84**		1.59**
Education:								
< HighSchool		0.65**		0.74		0.59**		0.49**
HighSchool Grad.		0.80*		0.75		1.05		0.71*
>HighSchool Grad.		ref.		ref.		ref.		ref.
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.11		0.99		1.22		1.18
Rural		0.79*		0.72**		1.26		0.74
Income		0.96**		0.96**		0.99		0.95**
Health Insurance		0.75**		0.71**		0.80		0.75*
Age		1.02**		1.02		1.02*		1.04**
Ever Been Pregnant		0.91		0.75*		1.38		1.26
Model Fit Statistics:								
Unweighted Pseudo R^2	0.035	0.069	0.047	0.072	0.021	0.055	0.029	0.060
F-adjusted test statistic	24.85	2.98	22.31	2.67	80.98	10.29	32.68	5.62
p-value	$3.03\ e^{-19}$	0.004	$5.59e^{-18}$	0.01	$2.87e^{-35}$	$3.31e^{-10}$	$1.21e^{-22}$	$6.34e^{-6}$
N	6487	6033	3528	3313	1233	1148	1406	1277

* $p < 0.10$ **$p < 0.05$

For the logistic regression model for White respondents, I found results similar to the results found in the initial, overall model. All three sexual risk factor variables were significant, and all three remain significant in the presence of controls. The sexual risk scale variable, significant at the $p<.10$ level, indicated that for every increase in the sexual risk scale, White women were 5% more likely to be tested for HIV, a slightly higher level than was found in the overall model. Drug use was also significant, although the magnitude of the odds ratio was slightly lower than that of the overall model. Finally, the total number of sexual partners was identical to the level of the overall model. The results for Black and Hispanic women, however, were different. While initially significant in the model for Black women, the sexual risk scale variable loses significance in the presence of controls and is never significant for Hispanic women. Drug use, however, is significant for both Black and Hispanic women, with a magnitude that is higher than that of White women. For White women, being a drug user increased the likelihood of being tested by 85%. Black women who were drug users were 113% more likely to be tested than non drug users, and Hispanic drug users were 133% more likely to be tested than were Hispanic non-drug users. Finally, results for the total # of sexual partners was consistent across all groups, with all three race groups indicating a significant 4% increase in the likelihood of being tested for HIV for each additional sexual partner.

In addition to the results for the sexual risk factor variables, there were also notable differences between groups in the relationship between the additional independent variables and the likelihood of being tested for HIV. For example, marital status was significant across all groups (with the exception of single status for White women), however the odds ratios associated with marital status were much larger for Black women. For example, single, Black women were nearly 3 times more likely to be tested for HIV than married Black women. In comparison, single, Hispanic women were only 1.59 times more likely to be tested than married, Hispanic women. By-race results also indicated that the relationship for education was not significant for White women, while both Black and Hispanic women with less than a high school education were significantly less likely to be tested than their same-race, college-educated counterparts. Income was significant and of similar magnitude for White and Hispanic women, but not significant for Black women, with a similar result found for health insurance status. Pregnancy status was only significant for White women, with a negative effect indicating that White women who have previous been pregnant are significantly less likely to have received an HIV test unrelated to blood donation, pregnancy, or routine testing. Finally, age was not significantly related to HIV testing for White women, but was significant, with a positive relationship for Black and Hispanic women.

To further rule out the possibility of these results being affected by the measurement of the independent variables, I also repeated the logistic regression results for all races for the other three methods of categorizing sexual risk, as discussed in Chapter IV. Full tables with these results are presented in the Appendix. These results include measuring risk using the individual sexual risk factor variables, a dichotomous "sexual risk" variable, a variable that counts the total number of sexual risk factors, and a combined "high risk sex" variable with remaining individual risk factors. In summary, I found that regardless of the way sexual risk was measured, the results found in the full model were only found for White respondents, with no significant relationship found between sexual risk and the likelihood of being tested for HIV for Black or Hispanic women.

"Pooled" Logistic Regression Model with Race Interactions

While the results in the previous section suggest that the relationship between risk and HIV testing differs across models by race, there remains a concern that these non-significant findings are impacted by low statistical power rather than a truly non-significant relationship. Given that the magnitude of the odds ratio for the sexual risk scale is similar across all models, and that the sample size for White respondents is substantially larger than that for Black and Hispanic respondents, it is possible that low statistical power is impacting my results. In order to further assess my results, and to check for this possibility, I have followed up these by-race models by specifying a logistic regression model that uses interaction terms to test for significant differences by race. In this model I increase statistical power by pooling all groups and increasing overall sample size. The results for this model are found in Table 5.5.[3]

[3] I have also calculated a pooled logistic regression model with interaction terms by race that uses the "high risk sex" variable with remaining individual risk factors. This model is reported in the Appendix and gives similar results.

Table 5.5. Logistic Regression Results (ORs) for HIV Testing, Pooled Model with Race Interaction Effects

	Model 1	Model 2
Race:		
White	ref.	ref.
Black	2.23**	1.74**
Hispanic	1.46**	1.27**
Risk Factors:		
Drug Use	2.21**	1.86**
Drug Use*Black	0.74	1.06
Drug Use*Hispanic	0.91	1.19
Sexual Risk Scale	1.07	1.05*
Sexual Risk Scale*Black	0.97	0.99
Sexual Risk Scale*Hispanic	0.99	1.00
Total # of Sexual Partners	1.04	1.04*
Marital Status:		
Married		ref.
Cohabiting		1.55**
Previously Married		1.75**
Single		1.61**
Education:		
< HighSchool		0.63**
HighSchool Grad.		0.80*
>HighSchool Grad.		ref.
Place of Residence:		
Urban		ref.
Suburban		1.08
Rural		0.78*
Income		0.96**
Health Insurance		0.73**
Age		1.02**
Ever Been Pregnant		0.91
Model Fit Statistics:		
Unweighted Pseudo R^2	0.048	0.071
F-adjusted test statistic	10.10	2.76
p-value	$4.80e^{-10}$	0.0074
N	6167	5738

$* \ p < 0.10$ $** p < 0.05$

In my interaction model, I found that the interaction terms for the sexual risk scale and drug use variables were not significant. This indicates that differences in the effect of these variables between race groups were not significant. Thus, the positive impact of risk and testing seen in the full model and the model for Whites is the "best" estimate for Blacks and Hispanics. These findings provide support for my concerns that low statistical power in my previous models by race could be masking a significant effect of the sexual risk scale variable. These results also indicate that the sexual risk scale does have a significant effect on increasing the likelihood of being tested for HIV for Black and Hispanic women, similar to its effect for White women.

Discussion and Results of Hypothesis Testing

Because of the key differences in the prevalence of HIV for women of different racial groups, it was imperative that I include in this dissertation an evaluation of race. More importantly, I wanted to evaluate whether or not the results found in the previous two chapters were similar across racial groups, or if there were important differences. While the finding of a relationship between risk and HIV testing overall does have an important public health impact, the disproportionate effect of HIV on the African-American community makes this relationship even more vital for this group. In this chapter, I sought to explore these relationships by testing the following hypotheses:

H.4: Women of different race/ethnic groups are hypothesized to differ in their prevalence of known risk factors. Following previous research, I hypothesize that African American women will have the highest prevalence of risk.

H.5: In addition to risk factors, women are also hypothesized to differ in their HIV testing behavior in accordance with their difference in risk.

For H.4, I did in fact find support for the hypothesis that racial groups differed in their prevalence of risk factors. In addition, I found that for nearly all risk factors, Black women had a statistically significant higher prevalence than did White women. The only exception I found was for the risk factors representing Involuntary Intercourse and drug use. Differences by race for Involuntary Intercourse were not found to be significant, while White women were found to have a significantly higher reported prevalence of Drug Use than Black women. For all other risk factors, including the ones that represented the largest magnitude of risk, African American women were found to have the highest prevalence of risk. This finding was not surprising in light of the higher prevalence of HIV infection found in this population. Hispanic women, however, were found to have a prevalence of risk that was similar to White women, with the exception of having another STI.

My main focus for this chapter, however, was on hypothesis H.5. In my initial, bivariate analysis I found that women differed in their HIV testing behavior, and that Black women did report significantly higher rates of HIV testing. This provided some support for my fifth hypothesis. When examining the relationship between risk and HIV testing for women of different racial groups, however, my findings were mixed. In my initial, by-race logistic regression models, there was not a significant relationship between having a sexual risk factor and the likelihood of being tested for Black and Hispanic women. These findings were called into question, however, by the results of my logistic regression models that used interaction terms for race. This methodological exercise further highlighted the concerns related to statistical power that have surfaced throughout my dissertation research. Given the discordant results of my models, I do not find support for a difference in the effect of the sexual risk variables by race. Since Black women were found to have significantly higher levels of risk, and previous literature has firmly established that this population has higher levels of HIV than White women, I did not find evidence that Black women were significantly different from White women in the relationship between risk and the likelihood to be tested for HIV. In addition, for variables that represented the highest magnitude of substantive risk (i.e. "high risk sex"), there was no significant relationship found between risk and the likelihood of being tested for any race (see results reported in the Appendix). The substantive importance of these findings will be further discussed in the final chapter of this dissertation.

CHAPTER VI

COMPARISON OF MALE AND FEMALE DATA

The final substantive question I address in this dissertation is to analyze the differences in the relationship between risk and HIV testing for women versus men. While the main focus of my dissertation is the status of HIV testing in women, a comparison of the relationship examined in previous chapters to the relationship between risk and testing status in men can shed further light on these results. As discussed in the literature review, the risk patterns for men are closely related to homosexual male contact. In addition, public health efforts continue to heavily target this population. Due to these factors, I would expect to find differences in the relationship between risk and HIV testing behavior between the male and female populations. In this chapter, I estimate models for male respondents and compare these results to the results previously obtained for female respondents.

Data and Methods

As in previous chapters, the 2002 wave of the National Survey of Family Growth data is used, however in this chapter I focus mainly on the male dataset to provide a comparison to the results obtained from the female dataset. The male dataset contains a sample of 4,928 male respondents, with similar characteristics as the female dataset.

Although the topical focus of the survey was the same, the questionnaires used for males and females were considerably different. Because of this, the variables are not always directly comparable and the same variables are not necessarily available in both datasets. While direct comparison of all individual risk variables is not possible, it is possible to evaluate the relationship between risk and testing status in a broad sense, and to compare differences in the distribution of HIV testing status between males and females. Like the female dataset, male questionnaires are administered by female face to face interviewers and answers to sensitive questions are entered directly into the computer by the respondents. Questions about HIV testing are very similar to the question format of the female questionnaire, in that respondents are not asked the results of any HIV test they have received.

As in previous chapters, I also utilize logistic regression to model the relationship between risk and a male respondent's likelihood of being tested for HIV. I create a dependent variable for this chapter that is similar to that of the previous 2 chapters, which models HIV tests that are unrelated to blood donation or other routine testing. For males, the most important risk factor for HIV is male-to-male sexual behavior. The questionnaire for males includes several relevant questions that can be used to measure this type of sexual behavior. From these questions, I have created 4 independent variables that measure risk due to male homosexual activity. When examining the tolerances for these variables, however, there is an indication of multicolinearity between these variables. In order to avoid this multicolinearity, I have separated these four independent variables between two logistic regression models. In addition, for each model I have computed results both with and without control variables to determine if effects remain significant in the presence of relevant controls. As with the female datasets, the NSFG male data includes sample weights to take into account over-samples in the data. These weights are adjusted for the male dataset, and I included them in the analysis in accordance with the NSFG technical documentation. (NSFG, 2006) As in all previous chapters, I report logistic regression results using the antilog of the logit coefficients, or odds ratios to aid interpretation.

Relevant Variables

For this chapter, I am interested in utilizing variables that are as similar to the female dataset as possible, while accounting for the differences in risk patterns between males and females. Because of this, some variables are consistent across datasets while others are uniquely tied to either a male or female status. For example, variables related to pregnancy are unique to females while male-to-male sexual contact variables are only found in the male data. Furthermore, the biological method of transmission of the disease is such that male homosexual behavior carries a high risk of disease transmission while female same-sex behavior carries an extremely low risk of transmission. These differences in risk patterns also influences a difference in the way I conceptualized risk for males and females, and thus the variables I used to measure risk in this analysis.

The main dependent variable of interest in this chapter, as in the previous two chapters, is “active” HIV testing, which excludes testing due to blood donation or routine tests. As in the female dataset, male respondents are asked whether or not they have been tested for HIV as well as a follow up question that asks the reason for the test. This allows me to create a variable that is almost identical to the variable used in the female analysis, with the exception that "routine" HIV testing includes pregnancy-related tests for females while the male routine tests include only tests due to life insurance applications, marriage licenses, or hospital admissions. I coded this dependent variable "0" if the respondent reports having never received an HIV test or if the only reported test is related to blood donation or "routine" testing. I coded it "1" if any other HIV test is reported. For the bivariate portion of the descriptive analysis, I also created a dependent, categorical variable that categorizes respondents according to their testing status using the following categories:

- No HIV test
- HIV test related to blood donation only
- Only "routine" HIV test (hospital stay, life insurance, etc.)
- HIV test unrelated to blood donation or routine testing

Independent Variables – HIV Risk Factors

It is well known that the most significant HIV risk factor for men is male-to-male sexual contact. The survey includes extensive questions relating to the subject of sexual orientation, sexual activity with both males and females, and sexual desire. Some of these questions were more detailed than was necessary for these purposes, which resulted in an extremely small prevalence of these factors. In these cases, it was necessary to combine responses to some questions, while maintaining substantive integrity. For the male dataset, risk factors related to contact with males and females are kept separate, which is necessary since female to male transmission rates are relatively low in comparison to male-to-male transmission. The majority of these risk factor variables are dummy variables that I coded “1” if the respondent reports the presence of the risk factor and “0” if they do not. It is also important to note that the construction of the male questionnaire was significantly different from the female questionnaire. While some of the questions in both datasets are identical, there are many that are substantively different. This means that variables are not necessarily directly comparable across datasets, and that similar variables cannot always be constructed. For example, the “unprotected sex” variable that I used in the previous chapters is not able to be constructed using the male dataset, since the questions on condom use in the female dataset ask about overall consistency of condom use while the male dataset only asks whether or not a condom was used for specific times (i.e. “Was a condom used the *last* time you had sex?”). The relevant risk variables I included in the analysis of the male data are:

Drug Use – The drug use questions in the male dataset are virtually identical to the questions on this topic in the female dataset. This allows me to create for the creation of a drug use variable that is the same as the drug use variable used in the female data. The questions include whether or not the respondent has used IV drugs, crack, or cocaine in the previous 12 months. While IV drug use specifically is a significant factor for HIV, the extremely low overall prevalence of reports of IV drug use in the sample made this factor difficult to measure alone. Instead, a “drug use” variable was created using data compiled from the drug use questions. Respondents are coded as "1" if they report any of these drug use behaviors.

<u>Has other STI</u> – As with the drug use variable, this variable is also similar to the variable in the female dataset. This variable is created out of a series of questions that ask if the respondent has been treated for one of a series of sexually transmitted infections (STIs) in the previous 12 months. STIs included in the questionnaire are gonorrhea, Chlamydia, herpes, syphilis, or genital warts. This variable does not include treatment received for HIV infection. Respondents are coded as "1" on this variable if they report any one or more of these STIs.

<u>Jail</u> – The male dataset includes a question which asks whether or not the respondent has ever spent time in a jail, prison, or a juvenile detention center. The question is asked as one question, and does not differentiate the type of facility or length of incarceration. Long-term incarceration in a prison facility has been known to be a risk factor for HIV, however short-term detention in facilities such as county jails or juvenile facilities are fairly low-risk. Since this question does not differentiate, respondents to this question are more likely to represent short-term incarceration (such as an overnight stay due to a drunk driving arrest, for example), rather than the true risk population. This question is coded "1" if the respondent reported having ever spent time in a jail, prison, or juvenile detention center and "0" if the respondent does not report this.

<u>Sexual Orientation</u> – One option included in the dataset to measure risk due to male homosexual behavior is the question that asks sexual orientation. This question

asks the respondent to categorized their orientation as heterosexual, homosexual, bisexual, or something else. For the purposes of this dissertation, risk due to male to male sexual activity would include those who answered as homosexual or bisexual, White those answering as heterosexual would classify as not at risk. Since the exact intention of those answering "something else" is impossible to classify given the format of the question (i.e. there is no "specify" option), those respondents are combined with heterosexual respondents in this variable. It is also important to keep in mind that this variable only measures what the respondent says is their sexual orientation, and does not measure actual sexual activity. In summary, the "orientation" variable is coded "1" if the respondent answers that they are homosexual or bisexual and "0" if the respondent answers that they are heterosexual or something else.

Sex with any Male – This variable measures whether or not the respondent has actually engaged in male-to-male sexual activity, regardless of how their sexual orientation is specified. For this dissertation, I have combined responses to several different, more specific, questions to create this variable. The survey asks a series of 4 questions regarding participation in both oral and anal sex with another male. If the respondent answers "yes" to any one or more of these 4 questions then I have coded them as "1" on this variable. If the respondent answers "no" to ALL 4 of these questions, then they are coded "0" on this variable.

Sex with a High Risk Male - This variable is more specific than the previous one, and measures risk due to sex with a high risk male, rather than any male. For this variable, answers from a series of 4 questions are combined, due to very low prevalence individually. The first question asks whether or not the respondent has ever had any sexual contact with a male who is an IV drug user. The second question asks whether or not the respondent has ever had any sexual contact with a male that he knew had tested positive to HIV. The other two questions ask about prostitution. One asks whether or not the respondent has ever paid money or drugs to another male in exchange for sex and the other asks whether or not the respondent has received money or drugs from another male in exchange for sex. When coding this variable, I coded respondents as "1," representing risk, if they answered yes to at least one of these 4 questions. Respondents were coded "0" only if they responded no to all 4 questions.

Number of Male Sexual Partners – The final in the series of variables related to risk due to male/male sexual contact is the number of male sexual partners that the respondent reports, measured continuously.

Sex with a High Risk Female – In addition to the questions asked about sexual behaviors with males, there were also extensive questions asked about sexual behavior with females. To keep continuity with the variable measuring sex with a high risk male, I have categorized this variable in the same way. The responses to similar 4 questions (i.e. sex with a female IV drug user, sex with an HIV+ female, paying a female drugs or money for sex, and being paid drugs or money for sex with a female) are combined to create this variable. As in the previous variable, respondents are coded as "1," indicating risk if they answer yes to any one of these questions and "0" only if they answer no to all four questions.

Number of Female Sexual Partners – The other variable included that represents sexual activity with female partners is the number of female sexual partners. This variable is a continuous variable that measures the total number of female sexual partners reported in the respondent's lifetime, with the assumption that the level of risk increases as the number of sexual partners increases.

Independent Variables - Other

In addition to risk factors known to be associated with HIV infection, there are other variables that I included in the analysis. These control variables are virtually identical to the control variables used in the analysis of the female dataset, with the exclusion of the variable measuring pregnancy. I measured and coded these additional independent variables in the same way as they were for the female dataset, and they are as follows:

Race/ethnicity – The NSFG allow for the measurement of 3 racial categories (White, Black, and other), with one category for ethnicity, Hispanic. I have categorized these into 4 groups: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic other. In this chapter, these are measured as a series of dummy variables coded "1" if the respondent is of the specified race and "0" for all other respondents.

Marital Status – The NSFG data allows for 6 distinct marital status categories. These categories encompass both legal and non-legal statuses. These categories are: married, unmarried-cohabiting, divorced, married-separated, widowed and single. For this variable, respondents in the divorced, separated, and widowed categories are combined into one "previously married" category. As with race, marital status is measured with a series of dummy variables coded “1” if the respondent is of the specified marital status and “0” for all other respondents.

Education - There are several possible ways that the NSFG would allow to operationalize education. For this dissertation, I have chosen to measure educational attainment in 3 categories: less than a high school degree or equivalent, high school graduate or equivalent without any college, and high school graduate with at least some college or higher. These are measured as 3 dummy variables coded “1” if the respondent has the specified level of educational attainment and “0” for all other respondents.

Income – As with education, there were numerous variable in the dataset related to a respondent’s level of income. For this dissertation, I have utilized the question that asked for the respondent’s pre-tax family income for the previous year. Respondents were given 14 categories of income, and could give their responses in weekly, monthly or yearly amounts. These categories ranged from a low of $5,000 or less per year to a high of $75,000 or more. For this chapter, I have left the original income categories intact and have included income as a continuous variable, ranging from 1-14 depending on reported category.

Health Insurance – This variable measures whether the respondent had been covered by any health insurance program for all of the previous 12 months. This includes any type of coverage such as private insurance, employer-sponsored health insurance, and government-sponsored programs (Medicaid, Medicare, etc). Respondents were coded “1” if they reported being covered for all of the previous 12 months and “0” if they had no health insurance or experienced a lapse or loss of coverage.

Place of Residence – This variable categorizes respondent’s place of residence as urban, suburban, or rural. Respondents are classified as urban if they live in a census designated metropolitan statistical area, in a central city. Suburban respondents live in a census designated metropolitan statistical area that is not the central city. Respondents are designated as rural if they do not live in a census designated metropolitan statistical area. As before, this is measured using a series of dummy variables.

Age – Respondent’s age at the time of the survey is measured in continuous years of age.

Descriptive Results

Before estimating logistic models, I first performed a descriptive analysis of my relevant variables. In Table 6.1 I list descriptive results for HIV testing status and risk factors. For the dependent variable, HIV testing, 36.47% of men were found to have never been tested for HIV, while 63.53% were found to have had an HIV test. The majority of tests were in the “other HIV Test” category, comprising 35.69% of the sample. The next section of Table 6.1 includes the distribution of the relevant risk factors for males. The most prevalent of these risk factors was having spent time in a jail, prison, or juvenile detention center, which comprised 21.37% of male sample.

2.78% of males reported having had sex with a high risk female (including engaging in prostitution with a female, sex with an HIV+ female or sex with a female IV drug user).

As mentioned previously, the key risk variables for male respondents are related to homosexual sexual activity. The variables related to homosexual sexual activity for male respondents are orientation (respondent identifies as homosexual or bisexual), sex with any male, sex with a high-risk male, and number of male sexual partners. Interestingly, 4.07% of respondents identified themselves as homosexual or bisexual, while only 2.33% actually reported that they had engaged in sexual activity with a male. The percent reporting sex with a high risk male was extremely small, comprising only 0.37% of the sample. The mean number of male sexual partners for men in the sample was 0.22 partners, however this number is highly influenced by the 97.67% of the sample who reported never having had a male sexual partner. When restricting to only those men who reported at least one male sexual partner, the mean number of male sexual partners was 6.39. Finally, Table 6.1 also includes the two additional, continuous independent variables: age, with a mean of 29.82 years, and income, with a mean of 9.80 ($30,000-$34,999).

Table 6.1. Descriptive Results, HIV Testing Categories and Risk Factors, Male Data

	Percent	Mean	Standard Deviation
HIV Testing Status:			
No HIV Test	36.47	---------	---------
Blood Donation Test Only	16.99	---------	---------
Routine Test Only	10.85	---------	---------
Other HIV Test	35.69	---------	---------
Individual Risk Factors:			
Drug Use	7.44	---------	---------
Has Other STI	2.59	---------	---------
Jail	21.37	---------	---------
Sex with High Risk Fem.	2.78	---------	---------
Sex with High Risk Male	0.37	---------	---------
Sex with Any Male	2.33	---------	---------
Orientation (i.e. Homosexual or Bisexual)	4.07	---------	---------
Age	---------	29.82	0.23
Number of Male Sex Part.	---------	0.22	0.03
If at least one Male Part.	---------	6.39	0.44
Number of Female Sex Part.	---------	9.87	0.31
Income	---------	9.80	0.08

Note: Since these results are weighted to take into account the NSFG sample design, these are linearized standard errors, rather than standard deviations. The actual standard deviations for unweighted versions of these variables are substantially higher.

Table 6.2. Comparison of Male and Female Data for Selected Variables

	Male	Female
*HIV Testing:***		
No HIV Test	36.47	31.68
Blood Donation	16.99	13.37
Routine Test	10.85	26.68
Other HIV Test	35.69	28.28
Risk Factors:		
Drug Use**	7.44	3.20
Has other STI**	2.59	3.40
Mean # of opposite sex partners**	9.87	5.63

Note: Ideally, an analysis of the difference between males and females would be conducted for all risk variables, however the difference in construction of the questionnaires only allows for the comparison of these variables.

**Difference significant at the $p < 0.05$ level

In Table 6.2 I compare result from the male dataset to comparable results from the female dataset. In the female population, 31.68% had never been tested, and 28.28% reported an “other” test. The largest difference between males and females was in the “routine testing category” (10.85% versus 26.68%, respectively), however this is expected since this category includes pregnancy-related testing for female respondents. The differences between males and females in their distribution of HIV testing behavior was found to be significant at the $p < 0.05$ level.

As mentioned previously, only a few of the male risk factor variables are directly comparable to their counterparts in the female dataset. The variables that are comparable between males and females are also found in Table 6.2. These variables are drug use, has other STI, and number of opposite sex sexual partner variables. Males reported higher levels of drug use (7.44% versus 3.20% for females), lower prevalence of other STIs (2.59% versus 3.40%), and more opposite sex sexual partners (a mean of 9.87 versus 5.63 for women), with all differences significant at the $p < 0.05$ level.

Table 6.3. Descriptive Results, Additional Independent Variables, Male Data

	Percent
Marital Status:	
Married	42.21
Cohabiting	9.25
Previously Married	6.99
Single	41.55
Education:	
< High School	23.00
High School Grad.	31.52
> High School Grad.	45.48
Place of Residence:	
Urban	48.05
Suburban	33.34
Rural	18.61
Race:	
White	65.40
Black	11.91
Hispanic	16.67
Other	6.02
Health Insurance	70.61

Table 6.3 presents the univariate descriptive results for the additional independent variables included in the full models. This includes marital status, race, education, place of residence, and health insurance status. The majority of those in the male sample report being either married (42.21%) or single (41.55%). When appropriate sampling weights are applied to compensate for the over-samples by race, White respondents comprise 65.40% of the sample, followed by Hispanic respondents (16.67%), and Black respondents (11.91%). For the remaining variables, the majority of respondents reported having at least some college (45.48%), being urban residents (48.05%), and having been covered by health insurance (70.61%).

Following this univariate descriptive analysis, I also calculated percentages of each of the categorical independent variables for each of the categories of HIV testing. These results are presented in Table 6.4. In this table, percentages total across the rows. Percentages are calculated for respondents coded "1" for each of the dummy variables. For example, of those men who reported having been incarcerated, 26.97% reported that they had never had an HIV test, 17.79% report having only had an HIV test due to blood donation, 11.05% report a routine test, and the final 47.20% report having had a test unrelated to blood donation or routine testing. For all risk factors, the majority of respondents reported having had an HIV test of some type, and a Chi^2 analysis of all of these results were significant at either the $p < 0.05$ level or $p < 0.10$ level. The highest percentages of "other" HIV tests were for respondents who reported sex with a high risk male (92.31%) or having another STI (71.31%). It is also important to note that, in general, the percentage of respondents in the "other" HIV test category for male respondents with risk factors is markedly higher than for female respondents (see Table 6.3 in Chapter III).

The second half of Table 6.4 reports results of a cross tabulation of the other categorical independent variables with the three HIV testing categories. For race, I found a higher percentage of Black respondents to have been tested apart from blood donation or routine testing (45.72%) than were other races. Hispanic respondents were more likely than other groups to report never having been tested (44.64%) and White respondents were more likely than other groups to have only had a test due to blood donation (19.55%) or due to routine testing (12.68%). For marital status, the highest percentage of never having an HIV test was found for single men (50.23%) and previously married men had the highest percentage of having been tested apart from blood donation or routine testing, 50.62%. In the education categories, those with less than high school had the highest percentage of not having ever been tested (62.81%), with the highest rate of testing unrelated to blood donation or routine testing found in those with more than high school education (39.10%). Part of the relationship for education is likely due to the age of the sample, since the majority of men in the "less than high school" category are men who have not yet completed high school (that is, they are less than 18 years of age), rather than being "high school dropouts." χ^2 results were not found to be significant for high school graduates or those with urban or rural residence. All other results had a significant χ^2 at either the $p < 0.05$ or $p < 0.10$ level.

Table 6.4. Descriptive Results, Percent Distribution of Each Testing Category for Categorical Independent Variables, Male Data

	No HIV Test	Blood Donation	Routine Test	Other HIV Test	Total
Risk Factors:					
Drug Use**	27.57	13.57	3.46	55.39	100
Has Other STI**	16.84	7.04	4.75	71.37	100
Jail**	26.97	17.79	11.05	47.20	100
Sex with High Risk Fem.*	32.13	11.26	6.93	49.67	100
Sex with High Risk Male**	6.35	1.34	0.00	92.31	100
Sex with Any Male**	15.32	12.18	4.49	68.01	100
Orientation*	20.32	15.86	4.54	59.28	100
Race:					
White**	34.56	19.55	12.68	33.22	100
Black**	32.76	11.17	10.34	45.72	100
Hispanic**	44.64	10.73	6.34	38.29	100
Other*	41.97	17.97	4.53	35.53	100
Marital Status:					
Married**	26.78	21.12	18.26	33.84	100
Cohabiting**	27.60	14.64	8.40	49.35	100
Previously Married**	24.89	13.14	11.36	50.62	100
Single**	50.23	13.96	3.79	32.02	100
Education:					
< High School**	62.81	6.54	4.92	25.73	100
High School Grad.	33.49	18.04	10.63	37.84	100
> High School Grad.**	25.33	21.50	14.07	39.10	100
Place of Residence:					
Urban	36.21	17.31	11.17	35.31	100
Suburban*	35.38	15.06	10.02	39.55	100
Rural	39.10	19.61	11.52	29.78	100
Has Health Insurance**	37.17	18.26	11.38	33.18	100

* χ^2 $p < 0.10$ ** χ^2 $p < 0.05$

Logistic Regression Results

Following the descriptive analysis, I performed a logistic regression analysis of the data from the male survey. As mentioned in the methods section, I had some concerns about multicolinearity in the male data, specifically among the variables that represented homosexual activity. For example, every respondent who reported sex with a high risk male partner also, by definition, reported having had sex with a male. In order to correct for this, I separated the four variables related to male-to-male sexual contact in to two models. For each of these two models, I report results with and without the control variables for a total of 4 male models. Once these models had been separated, there was no indication of multicolinearity. Table 6.5 includes all of these results, along with the corresponding results from the female dataset, for reference. I have included the results from the female model that included the "high risk sex variable," created from a combination of the variables for prostitution, sex with a male prostitute, sex with an HIV+ male, and sex with a male IV drug user. I included this model for comparison since it most closely mirrors the models I present in this chapter for the male data. The outcome measured for all of these models is the likelihood that a respondent had been tested for HIV, apart from tests related to blood donation or routine testing.

The first model includes the male-to-male sexual contact variables, sex with any male and sexual orientation, along with the remainder of the male risk factor variables. In this model, the variables sex with any male, orientation, drug use, has other STI, and number of female sexual partners variables were all found to be significant, and their significance was maintained in the presence of controls. The variable representing having spent time in jail was initially significant at the $p < 0.10$ level, but lost significance in the presence of controls, and the variable “sex with a high risk female” was not significant. The variable sex with any male was significant at the $p < 0.10$ level, indicating that men who had had any same sex activity were 94% more likely to have been tested for HIV than men who had never had any same sex activity. The risk factor with the highest magnitude in this model was the “has other STI” variable, which indicated that men who report having had another STI were nearly three times more likely to have been tested for HIV than men with no other STIs. This compares to a magnitude of 1.54 for women on the same variable. The drug use variable, however, was similar between the male and female models. In both, drug use is significant at the $p < 0.05$ level, with an odds ratio of 1.94. Finally, the “number of female sexual partners” variable was similar in significance and magnitude to the “number of male sexual partners” variable in the female model, with an odds ratio of 1.03 found in the presence of controls for both models, indicating that the likelihood of being tested for HIV increases by 3% for each additional opposite sex sexual partner an individual has.

Table 6.5. Logistic Regression Results (ORs) for Male and Female Models

	Female Models			Male Models			
	Model 1	Model 2		Model 1	Model 2	Model 3	Model 4
Risk Factors:			*Risk Factors:*				
Bisexual Part.	1.85**	1.75**	Sex with Any Male	1.90*	1.94*	----------	----------
Has Other STI	1.60**	1.54**	Sex with High Risk Male	----------	----------	7.26**	14.83**
Unprotected Sex	1.55**	1.25*	Orientation	2.03**	1.99**	----------	----------
Total # of Sex Partners	1.04**	1.03**	# of Male Sex Parts.	----------	----------	1.11	1.10
Drug User	1.82**	1.94**					
Involuntary Intercourse	1.03	1.06	Drug Use	1.69**	1.94**	1.64**	1.89**
Non-Monogamous Part.	1.30**	1.06	Sex with High Risk Fem.	0.97	0.81	0.89	0.73
High Risk Sex	1.08	0.97	Jail	1.31*	1.25	1.33*	1.26
			Has Other STI	3.04**	2.94**	3.00**	2.86**
			# of Female Sex Parts.	1.04**	1.03**	1.04**	1.03**
Ever Been Pregnant		0.91					
Race:			*Race:*				
White		ref.	White		ref.		ref.
Black		1.75**	Black		1.55**		1.59**
Hispanic		1.26**	Hispanic		1.30		1.30
Other		0.90	Other		1.31		1.34
Marital Status:			*Marital Status:*				
Married		ref.	Married		ref.		ref.
Cohabiting		1.55**	Cohabiting		1.89**		1.88**
Previously Married		1.71**	Previously Married		1.49*		1.52*
Single		1.48**	Single		1.02		1.00
Education:			*Education:*				
< High School		0.65**	< High School		0.61**		0.60**
High School Grad.		0.80*	High School Grad.		0.85		0.83
> High School Grad.		ref.	> High School Grad.		ref.		ref.
Place of Residence:			*Place of Residence:*				
Urban		ref.	Urban		ref.		ref.
Suburban		1.10	Suburban		1.03		1.01
Rural		0.80*	Rural		0.72		0.74
Income		0.96**	Income		0.98		0.98
Health Insurance		0.74**	Health Insurance		0.85		0.84

Table 6.5. Continued

	Female Models			Male Models			
	Model 1	Model 2		Model 1	Model 2	Model 3	Model 4
Age		1.02**	Age		1.02**		1.02**
Model Fit Statistics:							
Unweighted Pseudo R^2	0.04	0.07		0.081	0.114	0.080	0.111
F-adjusted test statistic	23.69	3.69		6.12	3.46	5.82	2.88
p-value	$1.11\ e^{-18}$	0.001		$1.94e^{-6}$	0.001	$3.91e^{-6}$	0.006
N	6488	6034	N	3891	3615	3892	3602

*p < 0.10 ** p < 0.05

In the second set of male models, the male to male sexual contact variables, sex with a high risk male and number of male sexual partners, are included, along with the other male risk factor variables. The results for these variables are striking, with the variable sex with a high risk male both significant and of a strong magnitude, with its effect doubling in the presence of controls. This variable is significant at the $p<0.05$ level, and indicates that men who report having had sex with a high risk male are nearly 15 times more likely to have been tested for HIV than men who had not had sex with a high risk male. The number of male sexual partners variable, however, was not found to be significant. In the female model, however, most of the variables that represent sex with a high risk partner were not found to be significant, with the exception of sex with a bisexual partner. The values of the other risk factor variables were similar in this model, with the magnitude of the odds ratios slightly reduced for the drug use and "has other STI" variables.

The control variables included in the male model also had similar results across the two male models. For race, Black male respondents were found to be significantly more likely to have been tested for HIV than White males, while Hispanic and Other race statuses were not significant. When compared to the female model, the magnitude of the odds ratio for Black males is lower than the value for Black females. Additionally, Hispanic status was significant in the female model but not significant in the male models. For marital status, both cohabiting and previously married male respondents were significantly more likely to have been tested than married men, at the $p < 0.05$ and $p < 0.10$ levels, respectively. Both of these variables were also significant in the female models, however single marital status was also significant for females but was not significant for males. For education, men with less than a high school education were significantly less likely to have been tested than men with at least some college, which was similar to the relationship for women. Female high school graduates were also significant, however males were not. The place of residence variables, health insurance, and income variables were all found to be not significant for males. Finally, the age variable was significant for males, with a similar effect to that for females. Both males and females were found to be 2% more likely to have been tested for HIV for each additional year of age.

Discussion and Results of Hypothesis Testing

The goal of this chapter was to examine the differences between HIV testing behavior, and the relationship between risk and testing, between males and females. Specifically, this chapter was testing the following two hypotheses:

H.6: Women and men will differ in their HIV testing behavior. While there is a high overall prevalence of HIV testing in women due to pregnancy related testing, when HIV test are sorted by type of test, Men will be more likely to report having actively sought to be tested due to perceived risk. In other words, there will be significant differences between men and women in the reason why they were tested for HIV.

H.7: The relationship between having a known risk factor and being tested for HIV will be different for men and women. Specifically, I hypothesize that having a sexual risk factor for HIV will more strongly predict testing behavior for men than for women.

The results of the analysis conducted for this chapter indicated support for both of these hypotheses. For the first hypothesis, I did find that there was a significant difference between the HIV testing behavior of men and women. I found women to have a higher prevalence of "routine" testing than men, most likely due to the effect of testing during pregnancy. For Men, however, I found a higher prevalence of HIV tests in the "other" category, indicating actively seeking to be tested for HIV. I also found men to be slightly more likely to report testing due to blood donation or no testing at all than women.

For the second hypothesis, the results did indicate differences between the relationship between risk and "active" HIV testing for men and women. While the relationship between the risk factor variables representing drug use and number of opposite sex partners was similar for men and women, results for sexual risk factor variables was remarkably different. The variables representing male-to-male sexual contact were found to have a strong relationship with HIV testing status, with the exception of the number of male sexual partners. Although the variable representing sex with a high-risk male has the lowest prevalence in the sample of any of the variables that I included in my analysis, it had the highest odds ratio of all variables. These results lend support to the idea that public health education efforts targeting the male homosexual community have been successful in promoting HIV testing among high risk men, and that the message that ANY male to male sexual contact warrants testing (rather than only multiple partners). In addition, men with high-risk male partners have a particularly high rate of HIV testing, further indicating success with public health education initiatives to this population. Given that the number of males reporting these characteristics in this dataset is few, the presence of such strong and significant results further increases confidence in these results. In comparison, relationships between sexual risk factors and testing status in women were found to be either non-existent or much weaker than that for males. Even when changes are made to the way risk is categorized (as in results for Chapter IV), the magnitude of the odds ratios does not approach the magnitude found for these male risk factors. These results further support the idea of a "lag" in public perception of risk, and highlight the need for additional focus on female populations with risk factors.

CHAPTER VII

SUMMARY AND CONCLUSIONS

In this dissertation I examined the status of HIV testing for women in the United States. In particular, I was interested in whether or not women who were at risk for the disease were more likely to have sought to be tested for HIV. Since the epidemiology of the disease continues to change, and the prevalence continues to spread, research related to HIV can play an important role in developing prevention efforts and pinpointing populations for public health efforts to target. The results I found in this dissertation can help to identify important characteristics of the relationships between risk factors and HIV testing. Given the trends in the United States related to HIV, I was interested in the effects of sexual risk factors on the likelihood of HIV testing, and with a comparison of this effect between racial groups and between males and females.

In the area of race, previous research has found that African-American women are significantly over-represented among those who are HIV positive. In addition, African-American women are more likely to have contracted HIV from heterosexual contact than White women (CDC 2003, 2004). These trends point to the importance of evaluating the relationship between risk and testing for the African-American population in general. In this dissertation, I found that African-American women were significantly more likely to have risk for HIV due to sexual risk factors than were White women. Despite this finding, I did not find evidence to suggest that the relationship between risk and the likelihood to be tested for HIV was significantly different than that of White women.

When comparing males and females, it has been well established that the majority of HIV/AIDS cases are homosexual males, however the prevalence and the rate of new infections among heterosexual women has been increasing. Given that concerns regarding HIV/AIDS in the United States began among the homosexual male community (followed by IV drug users), and that public health efforts have been aggressively targeting these populations, I was concerned that there was a “lag” time in the public perception of risk, and the need to be tested, among the heterosexual, female community. By comparing the relationship between risk and testing for men to that found for women, I can see how the differences in disease trends and public health efforts translate into the likelihood that a person at risk will actively seek to be tested for HIV. In this dissertation, I found that risk factors for men, in general, more strongly predicted testing status than they did for women.

Results of Hypothesis Testing

In the analysis I presented in this dissertation, I had several key research goals. These goals were guided by the hypotheses outlined in Chapter II. Overall, I had mixed results related to my specific research hypotheses. In general, the broad focus of this dissertation was aimed at evaluating the relationship between risk and the likelihood of being tested for HIV in women. Previous research, as noted in the literature review, has found some evidence that individuals who have characteristics that put them at risk for HIV testing do have higher rates of having received an HIV test. For most of this research, however, risk was limited to a few, high risk factors and HIV testing did not separate out testing by type of test. In addition, most of this research was mainly descriptive in focus, and did not rule out important control variables. Separating out type of test is important since a relatively small proportion of "routine" tests are received by the population at risk. Research related to individuals who are currently living with HIV has found that very few of these individuals discovered their status from "routine" tests. In addition, individuals who actively seek out to be tested for HIV are also more likely to receive follow up counseling on their results than individuals who receive a test for "routine" reasons. All of these reasons suggest that it is important to separate out HIV tests by type of test when trying to substantively capture the population that is actively seeking to receive an HIV test due to perceived risk.

The results I found in Chapter III further illustrated the importance of properly specifying the dependent variable to measure HIV tests by type. I found that the relationship between risk and testing status was different when routine and blood donation tests were excluded. I also found mixed results between risk factors and the likelihood of HIV testing. For two risk factors, I did find support across all models measured. Drug use and the total number of sexual partners had a consistently positive effect on the likelihood of HIV testing. For women, drug use had an effect that was consistently larger in magnitude than any of the sexual risk factor effects. This provided strong support for my second hypothesis. For my first hypothesis, I did find evidence of some, positive relationship between risk and HIV testing, however not all risk factors were found to be significant.

In Chapter IV, I addressed a concern that arose throughout my dissertation research. This concern was related to low statistical power due to the low individual prevalence in the sample of several of my key variables. Given that some of these risk factors are rare, I would not expect to find many respondents with some of these factors, however a variable with a small prevalence can sometimes bias results towards a null finding, masking a truly significant relationship. The research I presented in Chapter IV addressed this problem, testing the hypothesis that the relationships between risk and HIV testing could change due to differences in the way theses variables were categorized. My intention was to increase the statistical power of the models, so that if a truly significant relationship was being impacted by low power it could be brought to the surface. A key concern, however, was that by combining these variables into one measure, important differences in my independent variables were lost. In this chapter, I did find that the relationship between risk and HIV testing varied when the method for categorizing risk was changed. In general, the findings from this chapter supported the idea that women with an increased risk for HIV due to sexual risk factors were significantly more likely to have been tested for HIV.

Although I did find evidence in Chapter IV of a significant relationship between sexual risk and HIV testing, the overall magnitude of these effects remained relatively small. In addition, the results of the follow-up/exploratory models in this chapter strongly suggest that the significant finding is due to the effects of the same variables that were significant initially, rather than the increased explanatory effects of the additional variables. These concerns about statistical power were carried over into Chapter V, where I explored the relationship between risk and testing for women of different race and ethnic groups.

The research that I presented in Chapter V was aimed at exploring risk, HIV testing, and the relationship between the two for Black, White and Hispanic women. The hypotheses I tested in this chapter were focused on determining if women of different race/ethnic groups were significantly different in these areas. I did find strong support for the hypothesis that women of different races are different in their prevalence of known risk factors, and that they display a different pattern of testing. I found that African-American women had a larger prevalence of risk than White women for almost every risk factor. For some of these risk factors, the differences between Black and White women were quite large. Likewise, I did find that women of different racial and ethnic groups were different in their general testing status. When comparing the relationship between risk status and testing status between these women, however, the results were more complex.

Given that African-American women are significantly more likely to be infected with HIV than White women, and that their prevalence of key risk factors is significantly higher, the desirable effect, from a public health standpoint, would be for risk status to have a stronger effect on the likelihood of HIV testing for Black women than its effect for White women. What I found, however, suggests that the relationship between risk and testing for Black women was no stronger than the relationship between risk and testing for White women, and could possibly be less strong. In addition, since my results also suggest that some, key high risk factors are not having a significant effect at all, this represents an important population for targeted public health intervention.

Finally, in Chapter VI I compared the relationships found throughout this dissertation for women to the relationship between risk and HIV testing in men. This comparison provided a dramatic contrast. Despite finding some significant effects between sexual risk factors and the likelihood of HIV testing for women, the effects for men were substantially higher in magnitude. From a public health standpoint, this is an important finding. It is key that interventions related to HIV prevention and testing continue to target men, especially homosexual men, since this population continues to exhibit high prevalences of HIV infection. It is also important to note here that the sexual risk factor with the largest magnitude for women was the variable that measured sex with a bisexual male. Since this risk factor is related, indirectly to male to male sexual contact, a positive result for this risk factor can also be related to the extent of public health intervention and public perceptions related to the male, homosexual population. It is clear from the results that I found in Chapter VI that public health intervention and education efforts are having a successful impact on encouraging testing among high risk, male populations. Given these successful efforts for men, it is important now that these intervention goals be expanded to include female, at-risk populations.

Implications and Directions for Further Research

The findings reported in this dissertation have the potential for significant public health implications. As mentioned previously, the number of women with HIV infection is growing rapidly, with the source of infection more likely to be related to sexual behavior than IV drug use. If women at risk due to sexual behavior, especially African-American women, are not being tested then the potential morbidity and mortality rates in women could continue to climb. Individuals who actively seek to be tested for HIV can be uniquely targeted for prevention measures. HIV testing can be related to reductions in both morbidity and mortality from HIV/AIDS. First, testing can be a primary prevention method since women with a negative test outcome who were seeking to be tested due to their perceived risk status can be counseled on how to better mitigate their risk status to prevent HIV infection in the future. Second, HIV testing can be a tertiary prevention method since women who test positive can be counseled on how to prevent spreading the disease to others. Finally, testing can also reduce HIV/AIDS related mortality since early diagnosis and treatment can have a significantly positive effect on future prognosis.

These results indicate the need for further policies that target the populations identified in this research. Ideally, strategies would be developed that targeted *all* sexually active women for testing, especially since the risk status of a sexual partner can be unknown. For example, incorporating HIV testing into the yearly exams that women are already strongly suggested to receive (such as pap smears), can help to further destigmatize and encourage testing. Given that universal testing is a costly undertaking that is not likely to be implemented in the near future, specific efforts that target the groups most at risk is imperative. While the evidence in this dissertation and elsewhere, does suggest that these efforts have been successful for homosexual men and drug users, and marginally successful for women at risk due to heterosexual behavior, it is important that efforts to target women, especially African-American women, are increased.

In this dissertation, I experience several limitations to fully evaluating my research question. The most significant of these limitations was the limitations imposed by my data source. While this dataset was a valuable tool in performing this research, the relatively low prevalence of some of the key risk factors in the data presented problems of low statistical power in my models. Additionally, since individuals were not asked about their HIV status, this information could not be evaluated in my dissertation. Another limitation of my dissertation was that it focused exclusively on data for the United States. It is well known that the HIV/AIDS epidemic is worldwide, with infection rates significantly higher in other countries. The effect of HIV/AIDS on women, one of the main focuses of this paper, is also significantly higher in other countries. For example, a recent report released by the United Nations reports that an estimated 13.5 million women are currently infected with HIV in Sub-Saharan Africa, with a total of 2.4 million Aids related deaths in 2005 (UNAIDS 2005). The global importance of HIV testing in women, therefore, is even higher than that of the United States alone.

There are several important directions for the research I presented here to take in the future. In addition to the variables I addressed in this dissertation, the NSFG data has a wealth of information. Specifically, data related to post-test education are a logical follow up to the analysis related to HIV testing. The NSFG data includes questions on whether or not respondents who had an HIV test were counseled after they received their results and what topics were covered during the counseling. Also, the data include questions related to the place where respondents received HIV testing, such as a doctor's office or a mobile testing clinic. Finally, the NSFG dataset is strengthened by being periodically re-collected. The research I presented in this dissertation is drawn from the 2002 wave of NSFG data, the most recent currently available. A new wave of data, however, is scheduled to be released later this year. This would allow to assess whether or not the relationships I found in this dissertation have changed over time. Given that there have been numerous public health interventions since 2002, including the *Know HIV* campaign discussed in the first two chapters, it would be important to determine what kind of impact these strategies have had. This data would shed light on the present status of HIV related education and prevention strategies and inform specific areas for improvement. Extensive research related to the HIV/AIDS epidemic overall, and women specifically, will continue to be of vital importance for the foreseeable future.

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APPENDIX

Table A.1. Logistic Regression Results (Odds Ratios) for HIV Testing, all Races and By Race, Using Individual Risk Factors

	All Races		White		Black		Hispanic	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Individual Sexual Risk Factors:								
Rape	1.03	1.05	1.15	1.17	0.82	0.84	1.01	0.94
Bisexual Part.	1.86**	1.75**	1.98**	1.95**	1.54	1.43	1.76	1.88
IV Drug-Using Part.	0.95	1.03	0.78	1.08	0.85	0.86	1.29	1.11
Prostitute	1.58	1.18	1.55	0.96	1.45	1.42	1.93	1.18
Sex with Male Prostitute	0.77	0.84	0.40	0.54	2.27	1.97	0.29*	0.91
Sex with HIV+ Male	0.78	0.76	1.41	1.14	0.34	0.42	1.62	0.84
Has Other STI	1.58**	1.53**	2.00**	1.88**	1.30	1.32	0.87	0.96
Non-Monogamous Part.	1.30**	1.06	1.23	1.15	1.22	0.88	1.04	0.87
Unprotected Sex	1.56**	1.26*	1.64**	1.24	1.27	1.26	1.45	1.24
Total # of Sex Partners	1.04**	1.03**	1.04**	1.04**	1.04**	1.03**	1.05**	1.04**
Drug User	1.80**	1.95**	1.81**	1.71**	1.52	2.00	1.75	2.30**
Race:								
White		ref.	---------	---------	---------	---------	---------	---------
Black		1.75**	---------	---------	---------	---------	---------	---------
Hispanic		1.27**	---------	---------	---------	---------	---------	---------
Other		0.97	---------	---------	---------	---------	---------	---------
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.55**		1.44**		2.31**		1.29*
Previously Married		1.72**		1.65**		2.26**		1.68**
Single		1.47**		1.26		2.86**		1.56**
Education:								
< HighSchool		0.65**		0.76		0.58**		0.48**
HighSchool Grad.		0.81*		0.75		1.04		0.71*
>HighSchool Grad.		ref.		ref.		ref.		ref.

Table A.1. Continued

	All Races		White		Black		Hispanic	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.11		0.98		1.25		1.18
Rural		0.80*		0.72**		1.27		0.75
Income		0.96**		0.96**		0.99		0.95**
Health Insurance		0.75**		0.71**		0.79		0.75*
Age		1.02**		1.02		1.02*		1.04**
Ever Been Pregnant		0.90		0.74*		1.38		1.25
Model Fit Statistics:								
Unweighted Pseudo R^2	0.040	0.070	0.054	0.074	0.027	0.057	0.032	0.062
F-adjusted test statistic	21.12	2.46	13.29	3.80	47.52	10.80	22.11	5.80
p-value	$2.38\ e^{-17}$	0.02	$1.69e^{-12}$	0.001	$1.25e^{-27}$	$1.28e^{-10}$	$7.11e^{-18}$	$4.06e^{-6}$
N	6487	6033	3528	3313	1233	1148	1406	1277

*p< 0.10 **p < 0.05

Table A.2. Logistic Regression Results (Odds Ratios) for HIV Testing, all Races and By Race, Using Number of Risk Factors

	All Races		White		Black		Hispanic	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Risk Factors:								
Number of Risk Factors	1.28**	1.15**	1.28**	1.17**	1.16**	1.08	1.16	1.08
Total # of Sex Partners	1.04**	1.03**	1.04**	1.04**	1.04**	1.04**	1.05**	1.04**
Drug User	1.97**	2.02**	2.02**	1.77**	1.61	2.12*	1.89*	2.29**
Race:								
White		ref.	---------	---------	---------	---------	---------	---------
Black		1.74**	---------	---------	---------	---------	---------	---------
Hispanic		1.28**	---------	---------	---------	---------	---------	---------
Other		0.91	---------	---------	---------	---------	---------	---------
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.55**		1.43**		2.35**		1.30*
Previously Married		1.72**		1.67**		2.26**		1.64**
Single		1.49**		1.28		2.82**		1.58**
Education:								
< HighSchool		0.65**		0.76		0.59**		0.49**
HighSchool Grad.		0.81*		0.75		1.05		0.71*
>HighSchool Grad.		ref.		ref.		ref.		ref.
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.11		0.99		1.22		1.19
Rural		0.79*		0.72**		1.26		0.74
Income		0.96**		0.96**		0.99		0.95**
Health Insurance		0.75**		0.71**		0.80		0.75*
Age		1.02**		1.02		1.02*		1.04**
Ever Been Pregnant		0.91		0.75*		1.37		1.26
Model Fit Statistics:								
Unweighted Pseudo R^2	0.038	0.069	0.05	0.073	0.023	0.055	0.03	0.06
F-adjusted test statistic	25.54	2.88	22.86	3.70	77.72	10.37	31.69	6.16
p-value	$1.41\ e^{-19}$	0.006	$2.91e^{-18}$	0.001	$1.16e^{-34}$	$2.88e^{-10}$	$3.01e^{-22}$	$1.78e^{-6}$
N	6487	6033	3528	3313	1233	1148	1406	1277

*p< 0.10 **p < 0.05

Table A.3. Logistic Regression Results (Odds Ratios) for HIV Testing, all Races and By Race, using Combined Sexual Risk

	All Races		White		Black		Hispanic	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Risk Factors:								
Any Sexual Risk Factor	1.77**	1.42**	1.80**	1.50**	1.48**	1.21	1.38**	1.23
Total # of Sex Partners	1.04**	1.03**	1.04**	1.04**	1.03**	1.03*	1.05**	1.04**
Drug User	1.95**	2.00**	1.96**	1.75**	1.59	2.11	1.86*	2.24**
Race:								
White		ref.	---------	---------	---------	---------	---------	---------
Black		1.74**	---------	---------	---------	---------	---------	---------
Hispanic		1.29**	---------	---------	---------	---------	---------	---------
Other		0.92	---------	---------	---------	---------	---------	---------
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.54**		1.43**		2.36**		1.29
Previously Married		1.67**		1.62**		2.22**		1.63**
Single		1.46**		1.25		2.79**		1.55**
Education:								
< HighSchool		0.65**		0.76		0.59**		0.49**
HighSchool Grad.		0.81*		0.76		1.05		0.71*
>HighSchool Grad.		ref.		ref.		ref.		ref.
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.10		0.98		1.22		1.18
Rural		0.79*		0.72**		1.26		0.74
Income		0.96**		0.96**		0.99		0.95**
Health Insurance		0.76**		0.73**		0.80		0.76*
Age		1.02**		1.02		1.02*		1.04**
Ever Been Pregnant		0.90		0.74*		1.36		1.25
Model Fit Statistics:								
Unweighted Pseudo R^2	0.042	0.071	0.054	0.074	0.026	0.056	0.032	0.062
F-adjusted test statistic	18.54	2.15	16.32	3.91	69.48	10.00	31.79	6.81
p-value	$6.70\ e^{-16}$	0.04	$1.52e^{-14}$	0.0004	$5.09e^{-33}$	$5.78e^{-10}$	$2.75e^{-22}$	$4.13e^{-7}$
N	6487	6033	3528	3313	1233	1148	1406	1277

*p <0.10 **p <0.05

Table A.4. Logistic Regression Results (Odds Ratios) for HIV Testing, all Races and By Race, using "High Risk Sex" Variable

	All Races		White		Black		Hispanic	
	Model 1	Model 2	*Model 1*	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
Risk Factors:								
Bisexual Part.	1.85**	1.75**	1.95**	1.93**	1.55	1.44	1.81	1.94
Has Other STI	1.60**	1.54**	2.00**	1.88**	1.35	1.37	0.89	0.97
Unprotected Sex	1.55**	1.25*	1.64**	1.24	1.26	1.26	1.39	1.18
Total # of Sex Partners	1.04**	1.03**	1.04**	1.04**	1.04**	1.04**	1.05**	1.04**
Drug User	1.82**	1.94**	1.86**	1.72**	1.58	2.13*	1.69	2.06*
Involuntary Intercourse	1.03	1.06	1.14	1.17	0.83	0.83	1.05	0.95
Non-Monogamous Part.	1.30**	1.06	1.22	1.14	1.24	0.91	1.02	0.85
High Risk Sex	1.08	0.97	1.01	1.04	0.99	0.92	0.91	0.83
Race:								
White		ref.	---------	---------	---------	---------	---------	---------
Black		1.75**	---------	---------	---------	---------	---------	---------
Hispanic		1.26**	---------	---------	---------	---------	---------	---------
Other		0.90	---------	---------	---------	---------	---------	---------
Marital Status:								
Married		ref.		ref.		ref.		ref.
Cohabiting		1.55**		1.43**		2.33**		1.30*
Previously Married		1.71**		1.64**		2.29**		1.65**
Single		1.48**		1.26		2.83**		1.59**
Education:								
< HighSchool		0.65**		0.76		0.59**		0.48**
HighSchool Grad.		0.80*		0.76		1.04		0.70
>HighSchool Grad.		ref.		ref.		ref.		ref.
Place of Residence:								
Urban		ref.		ref.		ref.		ref.
Suburban		1.10		0.98		1.24		1.17
Rural		0.80*		0.72**		1.27		0.75
Income		0.96**		0.96**		0.99		0.95**
Health Insurance		0.74**		0.71**		0.78		0.74*
Age		1.02**		1.02		1.02		1.04**
Ever Been Pregnant		0.91		0.74*		1.39		1.26

Table A.4. Continued

	All Races		White		Black		Hispanic	
	Model 1	Model 2	*Model 1*	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
Model Fit Statistics:								
Unweighted Pseudo R^2	0.04	0.07	0.053	0.074	0.025	0.056	0.030	0.061
F-adjusted test statistic	23.69	3.69	20.12	4.01	51.89	11.50	21.99	4.97
p-value	$1.11\ e^{-18}$	0.001	$8.34e^{-17}$	0.0003	$7.50e^{-29}$	$3.59e^{-11}$	$8.15e^{-18}$	$2.98e^{-5}$
N	6488	6034	3528	3313	1233	1148	1407	1278

*p< 0.10 **p <.05

Table A.5. Logistic Regression Results (Odds Ratios) for HIV Testing, Pooled Model with Race Interaction Effects, High Risk Sex Variable

	Model 1	Model 2
Race:		
White	ref.	ref.
Black	2.27**	1.80**
Hispanic	1.52**	1.32**
Risk Factors:		
Drug Use	1.86**	1.73**
Drug Use*Black	0.84	1.11
Drug Use*Hispanic	0.93	1.17
High Risk Sex	1.00	1.03
High Risk Sex*Black	0.98	0.96
High Risk Sex*Hispanic	0.94	0.91
Bisexual Part.	1.95**	1.95**
Bisexual Part* Black	0.79	0.76
Bisexual Part*Hispanic	0.93	1.00
Has Other STI	2.00**	1.85**
Has Other STI*Black	0.67	0.80
Has Other STI*Hispanic	0.46	0.57
Unprotected Sex	1.64**	1.21
Unprotected Sex*Black	0.75	1.11
Unprotected Sex*Hispanic	0.87	1.03
Involuntary Intercourse	1.14	1.16
Involuntary Intercourse*Black	0.72	0.68
Involuntary Intercourse*Hispanic	0.94	0.86
Non-Monogamous Part.	1.22	1.11
Non-Monogamous Part.*Black	1.01	0.87
Non-Monogamous Part.*Hispanic	0.86	0.75
Total # of Sexual Partners	1.04**	1.04**
Marital Status:		
Married		ref.
Cohabiting		1.54**
Previously Married		1.68**
Single		1.57**
Education:		
< HighSchool		0.64**
HighSchool Grad.		0.80**
>HighSchool Grad.		ref.
Place of Residence:		
Urban		ref.
Suburban		1.08
Rural		0.78**
Income		0.96**
Health Insurance		0.72**
Age		1.02**
Ever Been Pregnant		0.91
Model Fit Statistics:		
Unweighted Pseudo R^2	0.052	0.073
F-adjusted test statistic	8.47	3.08
p-value	$1.19e^{-08}$	0.003
N	6168	5739

*p<0.10 **p <0.05

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